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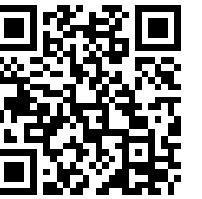

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THE

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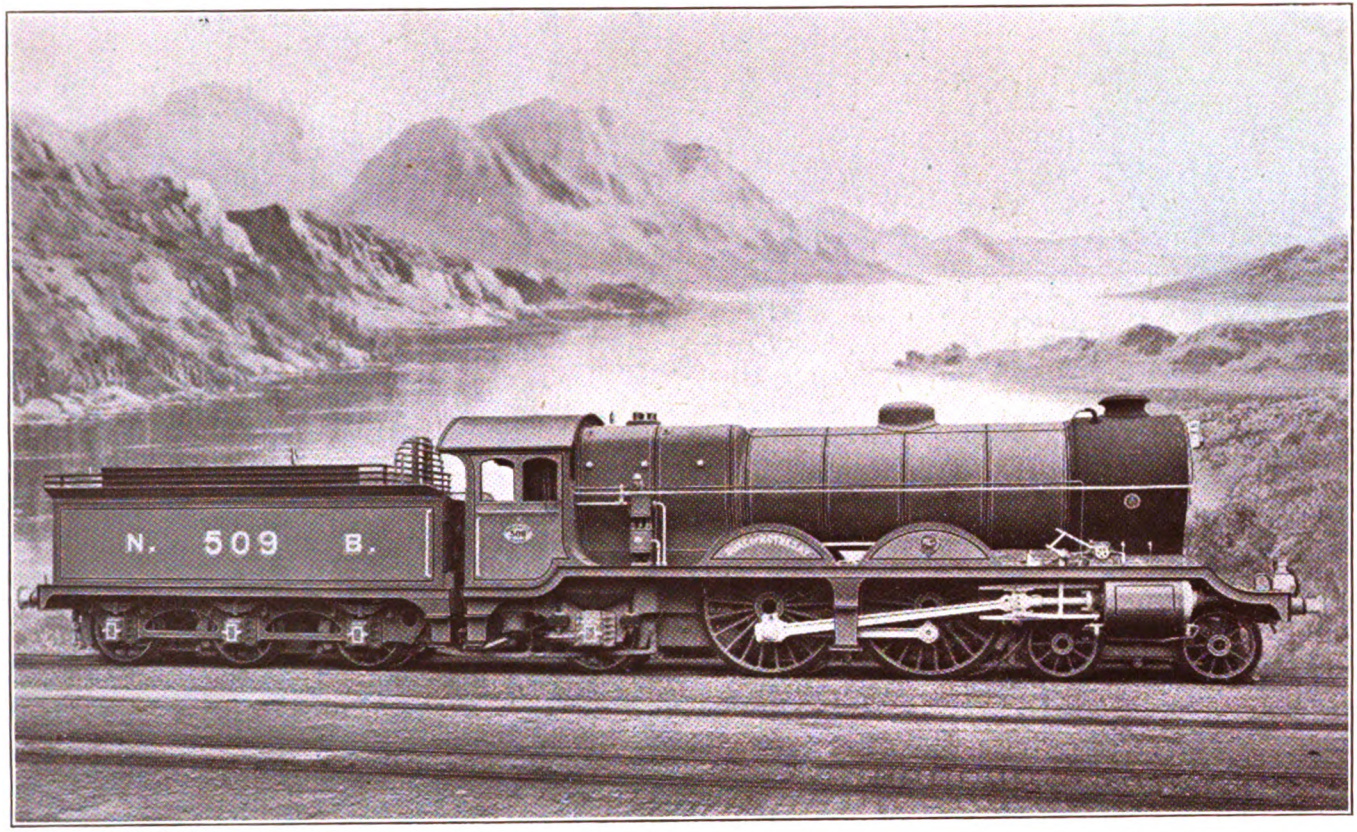

THE RAILWAY MAGAZINE.

SUPERHEATER "ATLANTIC" EXPRESS LOCOMOTIVE, No. 509 "DUKE OF ROTHESAY": NORTH BRITISH RAILWAY.

MR. W. CHALMERS, Chief Mechanical Engineer.

Cylinders, 21 in. by 28 in. Coupled Wheels, 6 ft. 9 in. diam Steam Pressure, 180 lbs. per sq. in.
Heating Surface—Large Tubes, 483 sq. ft.; Small Tubes, 1,136 sq. ft.; Firebox, 184·8 sq. ft.; Superheater, 385 sq. ft.; Total, 2,188·8 sq. ft.
Grate Area, 28·5 sq. ft. Weight of engine in working order, 76 tons 14 cwts.; Tender, 45 tons 8 cwts.; Engine and Tender, 122 tons 2 cwts.
Fitted with "Wakefield" Mechanical Lubricator.

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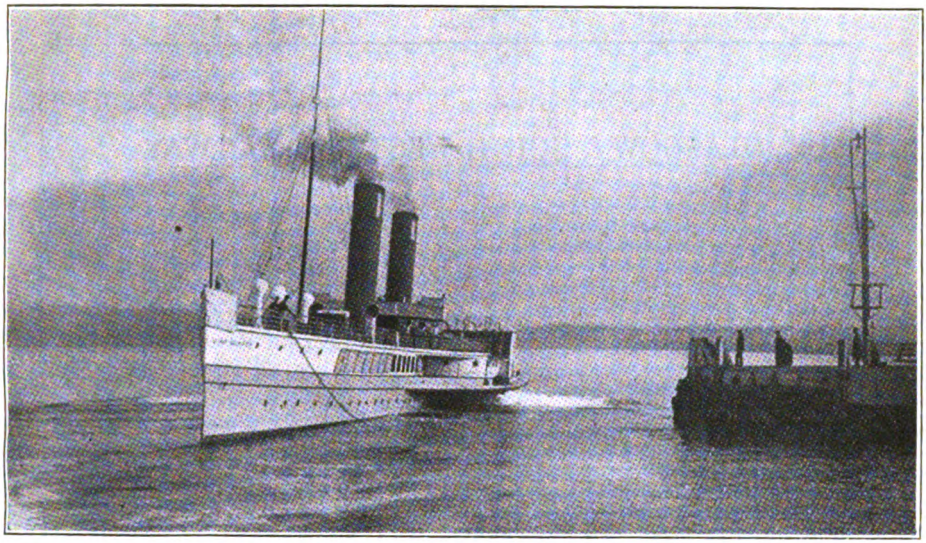

GLASGOW AND SOUTH WESTERN RAILWAY STEAMER "GLEN SANNOX" BACKING FROM WINTON (G. & S.W.R.) TO MONTGOMERY (C.R.) PIER AT ARDROSSAN.

The Coast Lines of the Glasgow and South Western Railway.

By J. F. GAIRNS, M.I.Loco.E.

(Photographs by the Author.)

IN the Firth of Clyde, Glasgow has a priceless possession, and the railways which serve the "Second City of the Empire" have seen to it that not only are the industrial and residential centres and the numerous pleasure resorts, which occur all along the mainland coast, well supplied with railway facilities, but that the western shores and the principal islands, which add so much to the beauty and attractiveness of the Firth, are equally well served by means of steamers running in connection with the mainland trains. In the northern reaches the Caledonian and North British Railways take approximately equal shares with the Glasgow and South Western in providing the famous Clyde rail and steamship services, but further south it is the "South Western" which is mainly concerned.

It is interesting to remember that the line from Glasgow to Ayr provided the original main line of the Glasgow and South Western Railway, opened as the Glasgow, Paisley, Kilmarnock and Ayr Railway in 1840. Ten years later the line was extended to reach Carlisle, and the Glasgow and South Western Railway was formed, but it was not until many years later that the Glasgow, Barrhead and Kilmarnock Joint Railway provided a shorter, though unfortunately severely graded, route to the south. As a result, the coast line services are operated quite independently of the present day main line services via Kilmarnock and Dumfries, and in practice the lines which pass through Paisley deal with the greater proportion of the total traffic of the entire system. The Glasgow and South Western is, in fact, probably unique in regard to the

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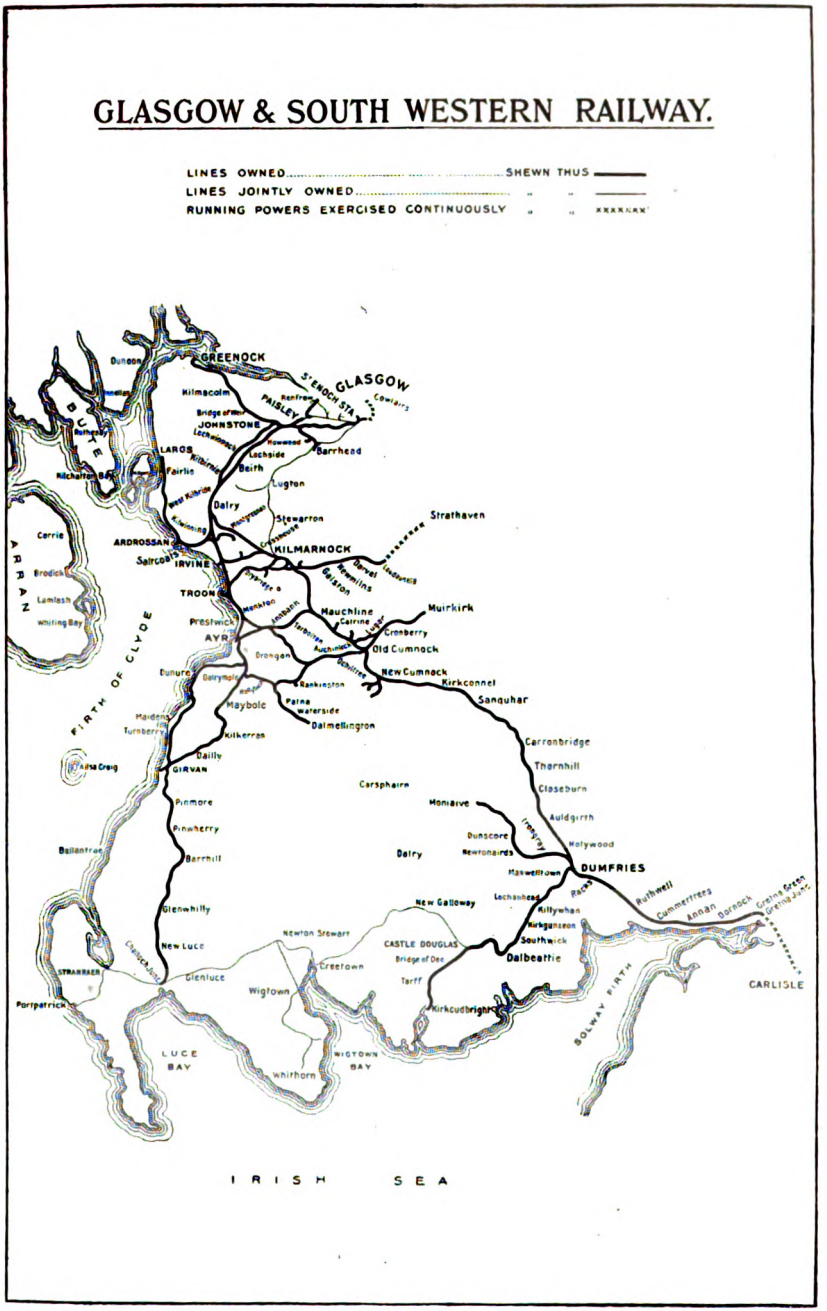

MAP OF GLASGOW & SOUTH WESTERN RAILWAY, SHOWING OWNED AND JOINTLY OWNED LINES, AND THOSE OVER WHICH RUNNING POWERS ARE EXERCISED CONTINUOUSLY.

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great volume of its relatively long-distance residential traffic. There are, indeed, large numbers of daily travellers for distances of between 30 and 40 miles, a fair proportion making even longer journeys, all due to the remarkable series of fast residential trains on the routes to Ayr, Largs and Greenock. In each case, too, there is a by no means inconsiderable regular traffic all the year round to the favourite holiday resorts of Bute and Arran, reached by means of steamers running in connection with fast trains, this applying all the year round though naturally the summer services have to be very much increased. The whole of this part of Scotland is, indeed, exceedingly attractive, for many of the places which are in particular favour for long-distance residential traffic are also principal holiday resorts, one being, in fact, the corollary to the other. It is also necessary to mention the sacred name of golf, modern courses, many world-famous, being found adjacent to nearly every station on the Glasgow and South Western system, particularly those lines which lead to and serve the coast resorts, while Arran and Bute add a considerable number which also are well known to golf enthusiasts.

Three more or less distinct train services are principally involved in the long-distance residential and holiday traffic of the Glasgow and South Western Railway (1) to Greenock, (2) to Saltcoats, Ardrossan, West Kilbride, Fairlie and Largs, and (3) to Irvine, Troon, Prestwick and Ayr. With the last mentioned requires to be associated the Dunure and Maidens Light Railway, which provides a coast alternative between Ayr and Girvan to the older line to Stranraer via Maybole. It is only necessary to mention that the light railway in question serves Turnberry, whose golf course and the Glasgow and South Western Railway Company's hotel have alike achieved world-wide fame among golfers.

A remarkable feature of the lines to be described is, however, the exceedingly useful alternative routes provided (*a*) between Glasgow and Elderslie and (*b*) between Elderslie and Dalry. It might be thought that their convergence upon Elderslie in each direction would cause that station to be somewhat of a bottleneck but in practice this is not so, owing to the provision of four lines and platforms at that station and a " burrowing " junction towards Greenock. The practical result is that, bearing in mind that the Glasgow and South Western policy for many years has been to encourage long-distance residential traffic rather than to cater for inner suburban traffic in Glasgow, it has become possible to run a large proportion of the trains as expresses. To all intents and purposes it may be said that a continuous series of fast trains can be run at close headway from Glasgow, the two routes to Elderslie enabling those which would otherwise conflict to run independently, while the divergence beyond Elderslie permits of non-stopping trains getting in front of or avoiding trains which call at certain stations on the particular section concerned. Trains to Greenock can thus take either route to Elderslie and need not conflict with a train for Dalry by the other route, while trains for Dalry or beyond can not only adopt either route between Glasgow and Elderslie but also have a choice of two routes thence to Dalry. All these possibilities are freely utilised in arranging the train services, with the result that numerous fast trains for all destinations concerned, including the route to Kilmarnock via Dalry, can be given on a remarkably free basis, while the policy of serving intermediate stations at busy periods by one otherwise fast train stopping at one or two stations and another at one or two others enables almost every station of residential importance to be given fast facilities without seriously adding to the journey times between Glasgow and more distant stations.

This aspect of ingeniously inter-worked train services will receive further attention in due course, but, meanwhile, the general features of the routes concerned may be briefly reviewed. Leaving St. Enoch Station in Glasgow and crossing the Clyde Bridge, the coast lines leave the Joint Lines direct to Kilmarnock via Barrhead at Gorbals Junction, 50 chains from the terminus. At Eglinton Street Station there are four tracks, the platforms being long and covered almost from end to end, as this is an important ticket-collecting station. Immediately below, but at right angles, is the Caledonian Station bearing the same name. At Port

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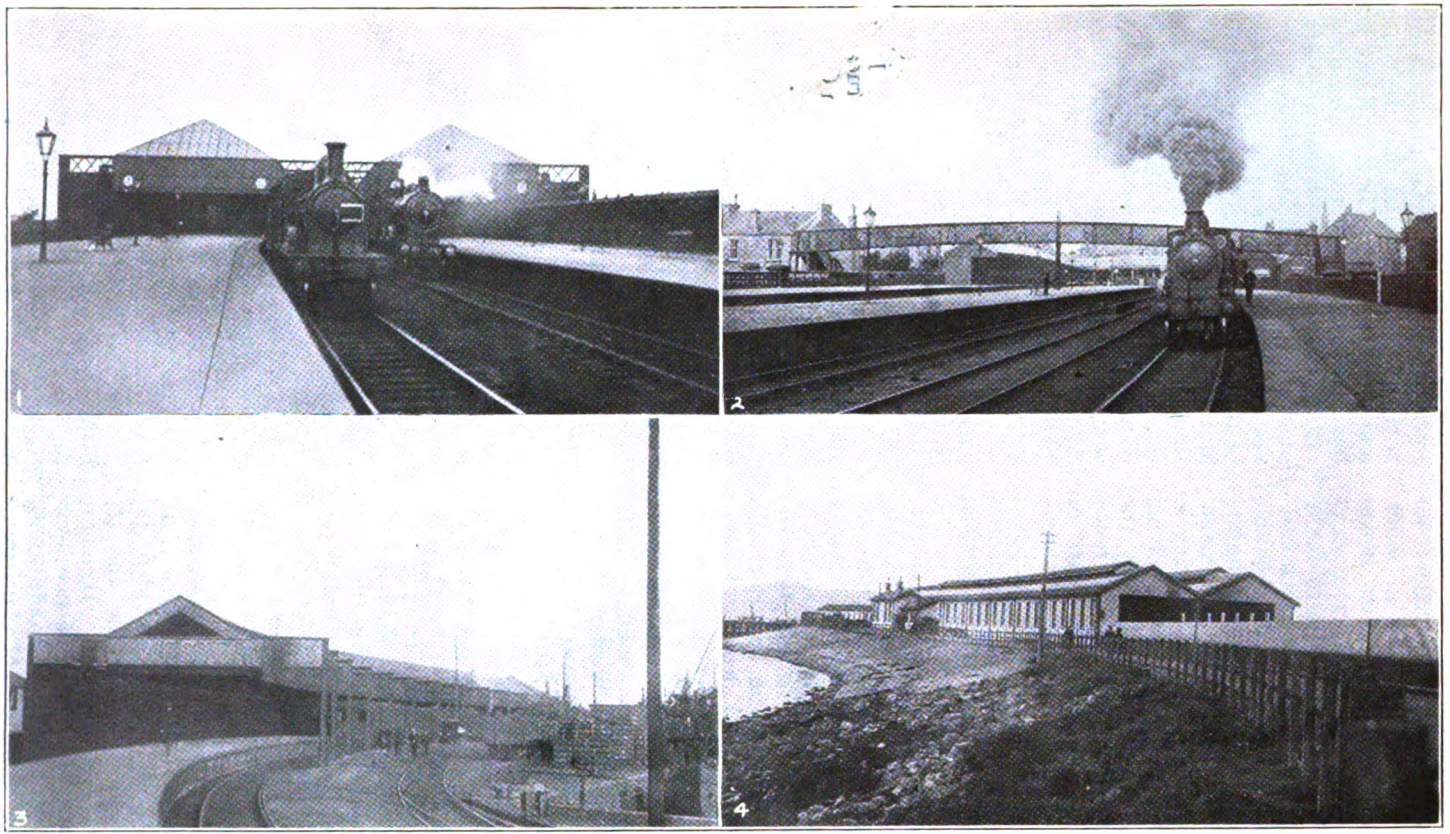

1. PRINCES PIER, GREENOCK.
2. LARGS.
3. WINTON PIER, ARDROSSAN.
4. FAIRLIE PIER.

VIEWS OF STATIONS USED FOR CLYDE STEAMER TRAFFIC, GLASGOW & SOUTH WESTERN RAILWAY.

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Eglinton Junction the two routes to Elderslie separate, a goods connection to the Glasgow "General Terminus" goods depôt descending in between to pass under the Glasgow and Paisley Joint Line and the Caledonian route from Glasgow Central station to the coast. The whole of this area is, in fact, a maze of junctions and inter-connecting lines, which need not be considered except as required for the purposes of this article. On the connection to the Glasgow and Paisley Joint Line the first station is Shields Road, adjoining which is Pollokshields Station into which the Caledonian trains from Glasgow Central come, one of the platforms in fact, belonging on the one side to one station while its northern face belongs to the other. Adjacent are the Caledonian carriage sidings. The "Canal Line" passes through a station bearing the name of Shields, to distinguish it from the adjacent stations. There is, however, an alternative connection from this line to the Joint Line, via Bellahouston Station, after which the two routes become quite distinct, the Joint Line serving Gilmour Street Station at Paisley, while the "Canal Line" serves the more southern portion of the town with the Canal and West stations.

The Joint Line is four-track for the entire distance between Shields Road (or Pollokshields) and Paisley (Gilmour Street) stations. The two intermediate stations, Ibrox and Cardonald, have platforms only to the outer lines, the through roads being in the centre, but neither of the companies concerned caters very seriously for the passenger traffic of these stations, though a few trains call to meet the needs of workmen and the industrial traffic of the district. Branches from this section lead to Princes Dock, Govan, Shieldhall and to Renfrew, both via King's Inch and via Abercorn. Gilmour Street Station at Paisley has four platform lines, the northern pair being reserved for Caledonian trains, which diverge to the right immediately to the west of the station. From Gilmour Street to Elderslie the line belongs only to the Glasgow and South Western Railway. The "Canal Line" serves Bellahouston, Corkerhill (for the Glasgow and South Western Railway engine depôt and "model village"), Crookston, Hawkhead and the Canal and West stations at Paisley. It is two-track throughout, with passing loops here and there. At Paisley (Canal) Station the writer noted the work of an enthusiastic staff. On the grass slope at the back of the up platform are set out in bobbins (indicative of the Town of Thread) and flowers the name of the station, with the coats of arms of the railway company and of the town of Paisley, crowned by a large scale inscription set out in stones, reading "Travel is a part of education. Golf at Turnberry finishes it." The thread mills of Messrs. Coats and Messrs. Clark are in the vicinity.

Elderslie Station, as already mentioned, is four-track, having two island platforms, either of which is available for trains to and from either route from Glasgow. Immediately beyond the station the Greenock branch diverges to the right by direct junction off the main line and by means also of a "burrowing" junction on the up side which goes under both the main lines, while the line from Greenock is duplicated for some distance into the station. Trains for the newer line to Dalry via Johnstone (North) Kilbarchan, Lochwinnoch and Kilbirnie, also leave the main line at this junction and pass over the Greenock line for a distance of about three-quarters of a mile before entering the new line at Cart Junction. The older line continues past Johnstone, Milliken Park, Howwood, Lochside, Beith and Glengarnock to Dalry. Speaking generally, this route has only the usual two lines, but in places running loops are provided, while in practice the alternative route via Kilbirnie constitutes a duplication. Several of the stations on the old route are centres of good-class residential traffic, while others have important mills, steel works and other industrial establishments adjacent to them. The whole of this part of Scotland is, in fact, dotted here and there with works and factories, though, as a rule, they stand alone and except in their immediate vicinity, the picturesqueness of the undulating country is not disturbed. The newer line is never far removed from the older one, but is generally at a higher level, and is proving of considerable value in opening up new and attractive residential districts.

At Dalry the railway is again four-track, the station having two island platforms

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and about half a mile beyond a branch of double line going through Montgreenan, Cunninghamhead and Crosshouse connects with the main line to the south at Kilmarnock. Work is in progress which will complete the four-track section as far as the next station—Kilwinning. The latter station is of ordinary junction type, the two direct lines leading in the Ayr direction, while the branch to Ardrossan diverges on a curve to the west. The Ayr route continues, after making connection with a junction direct from the Ardrossan line, past Bogside, Irvine, Gailes, Barassie, Troon, Monkton and Prestwick. At Irvine another line for Kilmarnock branches off, and at Barassie the Kilmarnock and Troon section comes in, this incorporating the first railway in Scotland, opened with horse traction in 1811. Trains which serve Troon have for some years taken a loop towards the coast, so as to pass through the new passenger station convenient to the town and also giving access to the harbour and industrial area. Non-stopping trains pass through the old station, now utilised only for dealing with goods traffic, and over a mile from the town from which it took its name. Ayr has up-to-date station premises, with two long through platforms, a bay with two platforms at the north end and two additional platforms, one at each side of the line at the south end of the station. There are refreshment and waiting rooms and booking halls on both the up and down sides of the line, and on the down side direct entrance to the Company's Station Hotel, a handsome and commodious edifice erected alongside the station. At Alloway Junction, about 1¾ miles to the south, the Dunure and Maidens Light Railway diverges to form a coast route to Girvan via Turnberry.

Returning to Kilwinning, the Ardrossan line first serves Stevenston, near which station the Caledonian line crosses, and thence to Ardrossan keeps approximately parallel but a little further inland. Adjacent are Nobel's Explosive Works. Approaching Saltcoats the Glasgow and South Western line comes close alongside the sea, in places separated only by a public walk, and then cuts across the promontory on which the town of Saltcoats is situated, but still quite close to the sea. Beyond this promontory is Ardrossan, of which town Saltcoats may be said to constitute a part, both places being very attractively situated. From the holiday point of view, the station at Ardrossan (South Beach) is the more important. This has the usual two platforms, and immediately beyond the station is a triangular junction enclosing the engine sheds. One section curves round into Ardrossan Town Station, through which the line is continued to the Pier Station. The Town station is a modern erection, with two through lines and a bay on the down side. The Pier Station has a single platform, with lines on either side, waiting rooms, booking hall, &c., being provided at the end, where access is given to Winton Pier. Constituting practically the opposite arm of the dock alongside, is the Caledonian Company's Montgomerie Pier and station, and since the Scottish Railways serving the Clyde have operated their steamer services more or less in common, the usual course has been that while both companies provided special boat expresses, the one steamer served the two piers, which are, in fact, separated only by about 100 ft.

Many trains which are proceeding beyond Ardrossan are divided at South Beach Station, one portion proceeding to the Town and Pier, while the other continues direct to Fairlie and (or) Largs. In some instances, however, trains go first into Ardrossan Town Station, leaving it again by the northern curve to proceed in the Largs direction. Trains proceeding from Ardrossan to Largs, after passing the connection from the Town Station, cross over the Caledonian line to Montgomerie Pier and then commence to climb a fairly severely graded section which gives magnificent views over the Firth of Clyde, with Arran in the distance. The railway follows the coast quite closely, and as West Kilbride is approached gives a splendid view of that pretty little town, itself a favourite holiday resort. After leaving West Kilbride Station there is a long run down the hill to Fairlie, still overlooking the Firth and giving interesting views of Millport and the Bute coast. Fairlie Station has the usual two platforms, but, on departing, the train traverses a fairly long tunnel. On leaving this at Fairlie Pier Junction, a short branch diverges into Fairlie Pier Station,

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which has three platforms, giving access direct to the pier itself. As the branch is very short, in the case of trains which are proceeding to Largs and have to call at the Pier station, the usual course is for them to run into the latter and then to back out to Fairlie Pier Junction, thence continuing the journey to Largs. Approaching the terminus at Largs the line is again quite close to the sea and comes to an end in a large four-platform station, with booking and waiting rooms fronting upon the main thoroughfare of this busy seaside resort, close to the pier. The station is laid out so that between

with. This section of line is very severely graded, the Glasgow and South Western route to Greenock climbing steadily, so that, as it nears the summit, magnificent views are had across the northern reaches of the Firth of Clyde to the hills beyond, and overlooking shipbuilding yards and industrial areas along the waterside. From the summit it descends at about 1 in 70 to Lynedoch Station, in the heart of the town of Greenock and continues on to Princes Pier Station, traversing a series of tunnels. The Pier Station provides four platforms, with waiting rooms, booking halls, and four wide covered

ARDROSSAN (SOUTH BEACH) STATION.
Junction for Ardrossan Town and Pier to left, to Fairlie and Largs to right.
Engine sheds between the respective lines.

each pair of lines there is a central line, Near the outer end of the station, a public footbridge crosses the station from side to side. A short distance from the station the line passes close to a curious tower erected as a memorial of the battle of Largs.

Returning to Elderslie, a few remarks in reference to the Greenock line will complete this section. The places served by Houston, Bridge of Weir, and Kilmacolm Stations rank very highly as residential districts; in fact, as will be seen, the two latter stations are given business expresses entirely to themselves, thus indicating the volume of traffic to be dealt

ways leading direct upon the pier, which is long enough, and often has to accommodate as many as four or five steamers at the same time during periods of pressure. Adjacent to the Pier Station is a rather attractive residential part of the town, facing the sea.

A few further remarks in regard to the places mentioned above will be in order before considering the train services. Largs, as already indicated, is a favourite seaside and holiday resort for Glasgow residents, and in the season has to deal with very heavy traffic, especially at the "month ends," when there is a general exchange of families leaving town or

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returning. Saltcoats, Ardrossan, West Kilbride, Troon, Prestwick and Ayr, may be placed in the same category, while the little village of Seamill (served by an omnibus service from West Kilbride) and Fairlie cater for traffic of very much the same class, though perhaps not in so great volume. Ardrossan provides the principal port for steamers to Brodick, Lamlash and Whiting Bay in Arran. It is also a fairly important shipping port, besides which steamers are run regularly between Ardrossan and Belfast on a daily service, and between Ardrossan and the Isle of Man in addition during the summer. Fairlie Pier is also used for steamers serving various places in the Firth of Clyde during the summer months, particularly Millport, Kilchattan Bay and Rothesay in the upper reaches, and West of Arran and Campbeltown in the lower direction. Princes Pier, Greenock, is, of course, a principal centre for reaching almost every part of the Firth of Clyde, while many other places mentioned, including Largs, Fairlie, Ardrossan, Troon and Ayr., are also calling places for steamers plying upon the Firth in various directions, and embracing special tours round Arran, through the Kyles of Bute, and up the Lochs. While, however, the holiday and steamer traffic is a very big factor, it must be remembered that all these lines serve districts which, as already indicated, are in favour for residential purposes all the year round, while not a few of them—such as Stevenston for the Ardeer Explosive Works, Irvine for its shipbuilding yards and chemical works, and Troon as a port—provide a considerable amount of industrial traffic, besides forming centres for workers associated with the industries in question. The town of Ayr is itself a place of considerable importance as the county town. There is also the harbour with its associated activities, and as the headquarters of the Burns country it attracts visitors from all parts of the Kingdom. In view of its exceptionally fine train services, a good number of Glasgow business men live at Ayr, although it is fully 41 miles distant. It is, besides, a great golfing centre and a favourite holiday resort on its own account.

In regard to golf, it is hardly possible to mention the number of courses available. The Glasgow and South Western Railway publish a Golfers' Map, and this shows no fewer than 34 first-class courses, mostly of 18 holes, and adjacent to stations between Glasgow and Greenock, Largs, Ayr and Girvan, together with a score or so of others at places on the Firth of Clyde rendered accessible by the railway steamers. Golf is, indeed, a great feature in this area, while at Turnberry the Glasgow and South Western Railway has provided two of the finest courses in Scotland, to which the railway company's hotel constitutes a by no means unimportant adjunct.

During the summer months there are of course, numerous express trains in connection with steamers, spread over the day, but including many running in the course of the business and residential traffic pressure, as they also enable holiday-makers to reach Glasgow in time for business, and others leaving town on Saturday afternoon and in the neighbourhood of 4 or 5 p.m. on other days. For example, during the past summer—and that was an attenuated version of what occurred in pre-war years—boat trains left St. Enoch for Princes Pier, Greenock, at 7.30, 10.5, 11.30 a.m., 1.45 (Saturdays only), 1.58 (except Saturdays), 2.40 (Saturdays only), and 4.3 p.m., some in connection with railway steamers, others with MacBrayne's, Williamson's and other independent vessels. Similar trains left Greenock at 8.15, 9.5, 10.10 a.m., 12.10 (Saturdays only), 4.15, 4.27 (Saturdays only), 5.20, 6.20, 7.20, 8.10 (Saturdays only), and 8.15 (Saturdays excepted) for Glasgow. Via Fairlie, boat trains left St. Enoch at 9.20, 11.35 a.m., 1.20 (except Saturdays), 1.45 (Saturdays only), and 5.25 p.m., with corresponding trains from Fairlie at 6.20 and 7.50 (Mondays only), 7.58 (except Mondays), 9.32 a.m., 2.10, 5.40, 6.5 (except Saturdays). and 6.25 p.m. (Saturdays only). Via Ardrossan trains left St. Enoch at 9.5 a.m., 12.20 (except Saturdays), 1.55 (Saturdays only), and 4.55 p.m., and from Ardrossan Pier for Glasgow at 8.18 a.m., 1.15 (except Saturdays), 1.25 (Saturday only), 4.50 (except Saturdays), and 6 p.m. (Saturdays only).

In October and winter months these are reduced to the 7.30, 10.5 a.m. and 4.3 p.m. from St. Enoch via Princes Pier, and 8.15 a.m. and 2.25 p.m. (Saturdays

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only) to Ardrossan, with the corresponding services in the opposite direction, of course. Many of these services, summer or winter, require fast trains in connection, but a special feature is the number of expresses on these routes which remain, and which therefore indicate the importance of the regular all-the-year-round residential and business traffic.

Including boat expresses, the ordinary evening homeward traffic was given, during the last summer, fast trains on the Greenock route at 4.3, 4.12, 5.12, 5.45 and 6.5 p.m., together with the 5.3 p.m. residential express for Bridge of Weir and Kilmacolm only. On the Largs and Ayr routes a large proportion of the trains are more or less fast, though only certain of the Largs trains are boat expresses. Most call at one or other of the Paisley stations, and the following list gives the starting time from St. Enoch, the first call after Paisley, and the final destination :—

	First stop (after Paisley)	Final Destination.
4 p.m. ..	Dalry	Largs.
4.10 p.m.	Prestwick ..	Stranraer
4.15 p.m.	Irvine	Ayr.
4.55 p.m.	Ardrossan (South Beach)	Ardrossan Pier and Largs.
5.10 p.m.	Ayr*	Tea car train to Girvan via Turnberry and via Maybole.
5.7 p.m.	Troon*	Ayr.
5.15 p.m.	Irvine	Ayr.
5.20 p.m.	West Kilbride*	Largs.
5.25 p.m.	Kilwinning ..	Largs.
5.55 p.m.	Irvine* ..	Ayr.
6.9 p.m.	Dalry	Largs.
6.20 p.m.	Kilwinning ..	Girvan.
7.15 p.m.	Dalry	Largs.
7.35 p.m.	Kilwinning ..	Ayr.

* Do not call at Paisley.

Several of these trains omit a few stations after the first stop mentioned, and there are, besides, other trains which call at stations from Paisley onwards. These routes, indeed, carry a constant succession of trains during the busy periods, and there are several interesting examples of train working. For example, the 5.7 p.m., which stops first at Troon, travels via Paisley (Canal), whereas the 5.10 p.m. Ayr and Turnberry express, booked to Ayr in 50 minutes, takes the Joint Line via Paisley (Gilmour Street); the two are booked to pass Elderslie within one minute of each other, as permitted by the four-track there, and again diverge, the 5.7 travelling via Kilbirnie and the 5.10 via Beith, so that the former is a few minutes behind when the two routes join again at Dalry.

The Saturday afternoon pressure is supplied, in the case of the Greenock route, by the 1.3, 1.37 and 1.45 p.m. fast trains from St. Enoch, while the Largs and Ayr routes have expresses at 12.30, 12.50, 1.0 (Ayr non-stop in 50 min.), 1.5, 1.10, 1.11, 1.15, 1.45, 1.55, 2.0, 2.2, 2.25, 3.5 and 3.15 p.m., apart from slower trains.

Arriving fast trains include from Greenock those due St. Enoch at 9.5, 9.17 (from Kilmacolm), and 9.55 a.m.

From other routes, including a large number of "Mondays Only" reliefs, the series of arrivals at St. Enoch is worthy of setting out in detail, as follows :—

Due at St. Enoch :—	From :—	Last stop before Paisley :—
7.22 (M.O.) ..	Largs ..	Stevenston.
7.40 (M.O.) ..	Fairlie Pier	Ardrossan (South Beach)
7.55 (M.O.) ..	Largs	Kilwinning.
8.3 (M.O.) ..	Girvan ..	Troon.
8.20	Ayr ..	Semi-fast throughout
8.38 (M.O.) ..	Largs ..	Kilwinning.
8.42 (M.O.) ..	Largs ..	Non-stop throughout.*
8.48 (M.E.) ..	Largs ..	Kilwinning.
8.48	Largs ..	West Kilbride.
8.50 (M.O.) ..	Troon ..	From Troon only.
8.55	Ayr ..	Irvine.
8.57 (M.O.) ..	Fairlie Pier	Non-stop throughout.*
9.5	Ayr ..	Barassie.
9.10	Fairlie Pier	Saltcoats.
9.11	Ardrossan Pier	Non-stop.
9.12 (M.O.) ..	Ayr ..	Non-stop throughout in 54 min.* Relief to following train.
9.15	Girvan ..	Ayr* (non-stop in 50 min.
9.35	Largs ..	Ardrossan (South Beach).
9.45	Ayr ..	Kilwinning.
9.53	Ardrossan Pier	Dalry.
10.7 (M.O.) ..	Stranraer ..	Ayr.
10.15 ..	Stranraer ..	Troon.

* Does not call at Paisley. Other trains call there and usually at Eglinton Street and sometimes at Shields or Shields Road also.

M.O. = Mondays only.

M.E. = Mondays Excepted.

These particulars, which applied during the summer months, do not, however,

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indicate the full volume of traffic falling to be dealt with at St. Enoch, as besides the trains from the Ayrshire Coast, as tabulated above, there are also trains from other districts, viz., Renfrew and Greenock Branches, and from the Main Line, via Barrhead as well as trains starting from intermediate stations, and taking the number of trains arriving at St. Enock say from 8.0 to 10.15 a.m., there are 39 on Mondays, and 34 except Mondays. This gives an average of 3½ minutes between each incoming train on Mondays, and an average of 4 minutes except Mondays, over the two sets of lines. There is, of course, a corresponding number of outgoing trains, either loaded or empty, in addition to shunting movements in connection with the trains. At Clyde Junction Signal Box the number of movements average about 80 per hour.

These services are not greatly reduced in the winter months, while most of the slower trains, many of which give good services for residential stations nearer town, apply all the year round.

Even these generous summer arrangements do not altogether meet the needs of the traffic on special occasions, such as the Glasgow Fair and the Glasgow Spring and Autumn Holidays, and for Ayr Races, &c. On these occasions many reliefs have to be inserted, even during the busiest periods, and the staff timetables show an apparently endless list of relief, additional, special and altered trains, in order to cope with the traffic.

It will be seen, therefore, that the Clyde and Ayrshire coast traffic is by no means a small item, and to cater for it the Glasgow and South Western Railway has had to provide alternative and widened lines on a liberal basis, and to supply train services which are more or less fast to a remarkable degree. Good loads are the rule, and although only the Greenock branch is particularly severely graded—exceptionally so in that case—both the 4-4-0's rebuilt by Mr. Whitelegg and those as yet unaltered, have their work cut out to maintain the reasonably fast schedules characteristic of these trains. But rarely is the Glasgow business man resident at any of the places within 40 miles required to spend more than 60 minutes on his journey, if as much, and for nearer places the time is frequently only about 30 minutes, and perhaps the remarkable feature is the varied manner in which so many stations are given fast facilities. The whole timetable is, in fact, worthy of careful study as an object lesson of what can be done in this manner.

Besides the Glasgow services, there are associated trains running direct from Kilmarnock to Ardrossan and Largs or to Ayr, but while these are fairly frequent and take important traffic, they do not need study in detail.

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British Locomotive Practice and Performance.

By CECIL J. ALLEN,
A.M.Inst.T., A.I.Loco.E.

Photo.] [*E. A. Gurney-Smith.*

GREAT NORTH OF SCOTLAND RAILWAY.
Inverness-Aberdeen Express passing Pitmedden.
4-4-0 locomotive, No. 17.

IN view of the near approach of the three-hundredth issue of the RAILWAY MAGAZINE, it hardly seems necessary in the present issue to occupy space in describing the locomotive activities of 1921. So far as my "best" runs of 1921 are concerned, two at least of them—one that epoch-making trip on the Great Western Railway "Cornish Riviera" down—made their bow to readers in the December number, and the remainder of the most outstanding journeys that I have timed will figure in a review of the accelerated Birmingham services destined for the February issue. For the present, therefore, though I had hoped to reply to various points raised in recent letters from correspondents, I must, in view of space exigencies, content myself with descriptions of a few runs timed during the past year upon Scottish lines.

Of my runs on the Caledonian Railway, undoubtedly the most interesting was one on the Glasgow portion of the 10 a.m. from Euston, seeing that, for the first time in my experience since well before the war, we essayed the formidable rise of 10 miles from Beattock to Summit without the assistance of a banking engine. This train is not booked to call at Beattock, and the load is usually quite moderate. On this occasion it consisted of six large eight-wheelers and a dining car—222 tons empty, and 235 tons with passengers and luggage. The engine was No. 116—a superheated 4-4-0 of the Pickersgill type. We got away rather slowly from Carlisle over the easy grades to the Solway bridge near Gretna, not exceeding 59 m.p.h.; Rockliffe, 4·1 miles, was passed in 7 min. 5 sec., and Gretna, 8·6 miles, in 11 min. 55 sec. The incline of 7½ miles at 1 in 193–200 from the river to mile-post 14½ produced a minimum of 41½ m.p.h., followed by a similar figure on the subsequent 4¼ miles at the same inclination to Brackenhill summit (mile-post 22); Kirkpatrick, 13 miles, was passed in 17¾ min., mile-post 14½ in 19 min. 50 sec., Kirtlebridge, 16·7 miles, in 22 min. 35 sec., Ecclefechan, 20·1 miles, in 26½ min., and Lockerbie, 25·8 miles, in 33 min. 5 sec. Very fair speed was made over the undulating stretch thence to Beattock, the 8·7 miles from Lockerbie to Wamphray taking 9 min., and the 5·2 miles on to Beattock 5 min. 50 sec.

The last-mentioned was a particularly good time, as the line ascends for 3½ miles

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at 1 in 202 and another ½ at 1 in 174 before Beattock station is reached. On this grade we fell from 67 m.p.h. near Wamphray to 50½ on commencing the famous "Bank" itself. This commences at 40 miles, and continues to 49¾ miles, steepening from 1 in 88 for two miles to a general average of 1 in 76 for the remainder, the steepest pitch actually being a short length at 1 in 69 just beyond Greskine Box. When our speed had settled down to a steady figure, commencing at mile-post 42, successive miles occupied approximately 115, 115, 130, 135, 140, 135 and 145 sec., with an absolute minimum of 24¾ m.p.h. So the 10 miles from Beattock to Summit, which we passed in exactly 68 min. from Carlisle, and 1 min. early, occupied 20 min. 5 sec. After this, however, we rolled so placidly down the falling grades to the River Clyde at Lamington, barely so much as touching 60 m.p.h. until reaching 64 at the bridge (the 13·5 miles from Summit to Lamington took no less than 15 min. 10 sec.), that we pulled up for the conditional stop at Symington nearly 1¾ min. late. The 68·9 miles from Carlisle had occupied 87 min. 40 sec. The remainder of the journey is of little interest, on account of the constant moderation of speed required over the colliery pitfall area. Carstairs, 6·6 miles, was passed in 9 min. 20 sec.; Law Junction, 17·2 miles, in 23 min. 25 sec.; Motherwell, 22·6 miles, in 30 min. 5 sec.; and Rutherglen, 32·3 miles, in 43 min. 50 sec., over a minute early. But a signal stop on the Clyde bridge prevented us from making an absolutely punctual arrival.

Another trip in the same direction was on the immediately preceding Manchester and Liverpool express, when No. 150, non-superheated McIntosh 4–4–0, had a train of nine eight-wheelers and a dining car, or 270 tons gross, on a day of violent westerly wind, which caught us badly on all exposed stretches of line. We passed Rockcliffe in 7 min. and Gretna in 12 min. from Carlisle, touching 58½ m.p.h. at the Solway; minimum at mile-post 14½ was 37 and at mile-post 22 38½ m.p.h., with a maximum of 53 at Kirtlebridge, which was passed in 24 min.; while Lockerbie was reached in 36 min, allowed 33. It is curious how all the stages mentioned were completed in exactly even minutes. From Lockerbie to Beattock, where the line is slightly less exposed, better running was made, Nethercleugh, 2·9 miles, being

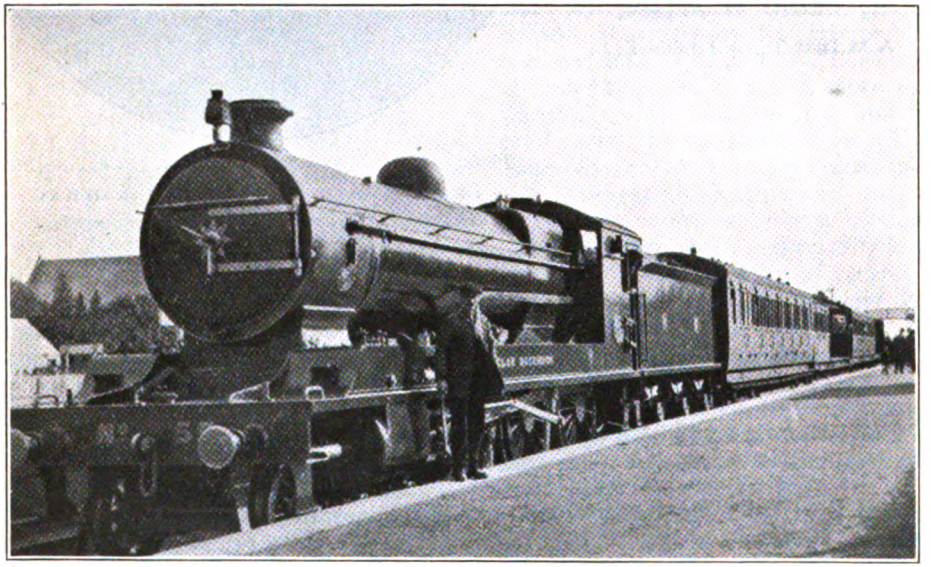

Photo.] HIGHLAND RAILWAY. [*D. B. Bradshaw.*

Inverness–Perth express at Kingussie. New superheater 4-6-0 locomotive, No. 55, "Clan Mackinnon."

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passed in 5¼ min., Wamphray, 8·7 miles, in 11 min. 50 sec., at 60 m.p.h., while we stopped at Beattock, 13·9 miles, in 18¼ min., allowed 18. From there, with the valuable assistance in rear of 4–6–2 tank No. 952, we mounted the 10 miles to Summit in the good time of 20½ min., attaining 33½ m.p.h., and then falling back to 29½; Summit to Lamington took 14 min. 10 sec., with very easy running most of the way, but a maximum of 69 m.p.h. at the Clyde bridge; Symington, 27·2 miles from Beattock, was passed in 38¾ min., and Carstairs, 33·8 miles, would have been reached in 47 min. 1½ miles at 1 in 148, occupied 15 min. 5 sec.; and the final 2·9 miles to Summit, 2¼ of which are at 1 in 99 (on which we fell to 30 m.p.h.) took 4¾ min. A brisk run of 10 min. 50 sec. down the 10 miles of the bank, during which we touched 69 m.p.h., but were for the most part restrained to about 60, brought us to the stop at Beattock in 37 min. 35 sec. from Symington, allowed 37 min. From Beattock we passed Wamphray, 5·2 miles, in 7 min. 25 sec., at 59 m.p.h., and reached Lockerbie, 13·9 miles, in 17½ min., against a schedule of 17 min. From Lockerbie we got through Ecclefechan, 5·7 miles

Photo. GLASGOW & SOUTH WESTERN RAILWAY. *J. F. Gairns.*

5.3 p.m. Glasgow–Kilmacolm express at Kilmacolm. Rebuilt 4-4-0 locomotive, No. 370.

(allowed 50) but for a preliminary signal stop. So the driver recovered the 3 min. he had lost on the first stage.

Coming up the same evening McIntosh superheater 4–4–0 No. 40, with a load of identical composition, but heavier by 10 tons, had driving rain to cope with in addition to the wind, which was now furious. The train was the 6.27 p.m. from Symington, at that time leaving Glasgow at 5 p.m. From Symington we passed Lamington, 3·7 miles, in 6 min. 55 sec.; the 10·6 miles of gradual rise from Lamington to Elvanfoot, mostly at an average of 1 in 300, but finishing with (of which the first four rise at 1 in 528–200), in 10 min. 5 sec.; Kirtlebridge, 9·1 miles, in 13 min. 35 sec.; Gretna, 17·2 miles, in 22¼ min. (the failure to so much as touch 60 m.p.h. on this bank, with the train already behind time, was to my mind without excuse); Rockcliffe, 21·7 miles, in 27 min. 25 sec.; and Carlisle was reached in 34 min. 5 sec., allowed 32 min. from Lockerbie—a total loss to engine of 3 min. Some of my younger friends, when comparing these times with the published times of this train at that period, would have thought that they had had a marvellous journey,

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regaining nearly 10 min. of arrears, but the public time-table cunningly concealed the fact that a wait of 16 min. was then allowed at Symington, in order that an express *fish* train might get ahead! Even I was deceived into thinking we had done quite well, until I had consulted the working book.

But the most interesting up journeys were two during the past summer on the vastly heavy day Scotch expresses, leaving Glasgow at 10 a.m. and 1.30 p.m. respectively. Time was lost on both trips, but in all the circumstances one could hardly be surprised. To Carstairs the 1.30 p.m. took a modest enough load of four 12-wheelers and an 8-wheeler, weighing 200 tons full; McIntosh superheated 4–4–0 No. 122 was the engine. Rutherglen, 3·1 miles, was passed in 6¼ min., and Uddingston, 8·5 miles, in 13¼ min. Here begins the steep rise to Craigenhill, mostly at 1 in 115–137 for the first 6½ miles, to beyond Flemington, and then worsening to about 1 in 100 for 3¼ miles further to Law Junction, after which come the final 5¾ miles, at 1 in 98–190, to Craigenhill Box. Despite this formidable rise, we passed Motherwell, 12·8 miles, in 19 min. 20 sec., at 40 m.p.h., and Law Junction, 18·2 miles, in 28 min., 2 min. early. We had been maintaining 37 m.p.h. on the 1 in 99, but now ran into the signals of the belated North portion, and so were delayed to Carstairs. At Carstairs the load was made up to no less than 63 axles —450 tons empty and 475 tons full—and we were allowed the old 4–4–0 No. 17 as pilot to Summit. A smart run was made over this section, Symington, 6·6 miles, being passed in 10 min. 50 sec. (despite 3½ miles up at 1 in 150–100), and Lamington, 10·3 miles, in 14 min. 55 sec., at 62½ m.p.h. Lamington-Elvanfoot occupied 11 min. 35 sec., and Elvanfoot-Summit (stop) 4 min. 20 sec., speed having fallen to 36 m.p.h. before steam was shut off. So Carstairs to Summit was run in 31 min. 50 sec., against the working allowance of 35 min. from start to pass.

Photo.] CALEDONIAN RAILWAY. [*E. A. Gurney-Smith.*

Up mail train from Aberdeen passing Portlethen. 4-4-0 locomotive, No. 897.

Reverting momentarily to the exploits of the sister engine—No. 121—on the 10 a.m. train, we had a considerably heavier load from the start of 38 axles, or 290 tons, but passed Rutherglen in 5 min. 55 sec., and Uddingston in 12¾ min.—both better times than those of No. 122 on the 1.30 p.m. Immediately afterwards, however, we were stopped for adverse signals and so took 25 min. to Motherwell, con-

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ditional stop. Re-starting 5 min. late, we lost 3¼ min. further to Symington, passing Law Junction, 5·4 miles, in 13½ min., at 27 m.p.h.; Craigenhill Box, 11·2 miles, in 24 min. 40 sec.; Carstairs, 16 miles, in 30 min. 25 sec.; and reaching Symington, 22·6 miles, in 39 min. 20 sec. Here our load was made up to 60 axles, 426 tons tare and 455 tons full, and being within the maximum of 440 tare tons allowed unpiloted (an extraordinary figure for 4-4-0 engines over such a road), we had to essay the climb to Beattock without assistance. Lamington was passed in 6¾ min., at 55 m.p.h.; Lamington-Elvanfoot took 16¼ min. and Elvanfoot-Summit took 4 min. 55 sec. and 5½ min.; Wamphray-Lockerbie, 9¾ and 10 min.; Lockerbie-Ecclefechan 7 min. 35 and 45 sec.; and Ecclefechan-Kirtlebridge, passed at 62½ and 65 m.p.h. after minima of 38 and 39 m.p.h. at Brackenhill, in 3 min. 20 and 25 sec. Beyond Kirtlebridge there was a severe p.w.r. slack on both runs, so that Kirtlebridge-Gretna occupied 8 min. 25 sec. and 10 min. 40 sec.; then, touching 67 and 61½ m.p.h. at the Solway, we ran from Gretna to Rockliffe in 4 min. 30 and 50 sec., and from there into Carlisle in 5½ min. on both runs—total 54 min. 20 sec. and 60 min. 5 sec., or 52 and 57 min. net respectively, from Summit. From Symington, on the morning run, we had therefore consumed 84 min. 10 sec., or 82 min. net, against 78 min. allowed, and from Carstairs on the afternoon train 93¾ min., or 91 min. net, against 90, but both runs were good in view of the onerous conditions of load and road.

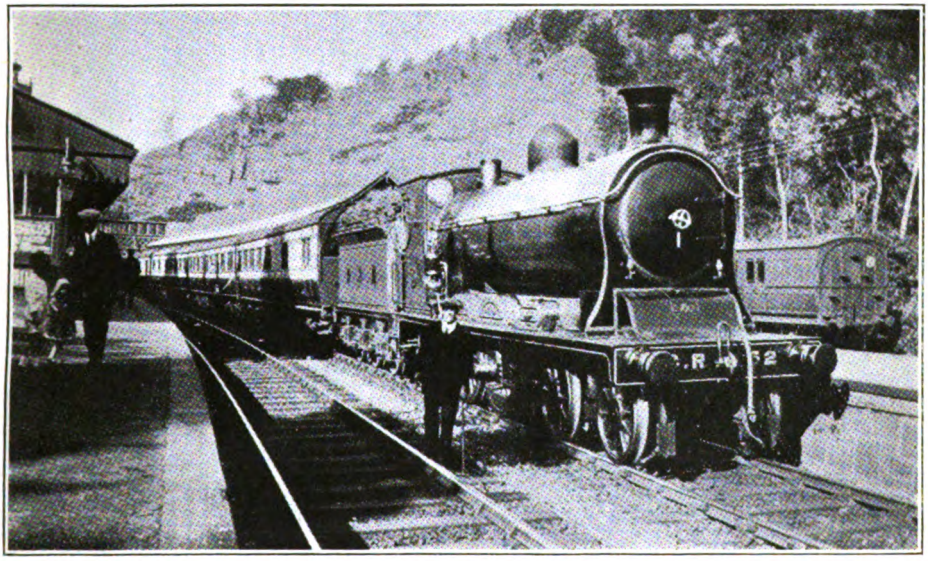

Photo. CALEDONIAN RAILWAY. [*Bernard Whicker.*

Oban–Edinburgh train at Callander. 4-6-0 locomotive (5 ft. class), No. 52.

5 min. 50 sec., with a minimum of 19 m.p.h. Our 29 min. 50 sec. from Symington to this point showed a loss of nearly 5 min., but on the 53 min. booking for the 49·7 miles from Summit to Carlisle the engine showed a net gain of quite a minute. No. 121 did much better than No. 122, indeed, as the latter, with only 20 tons more, lost 2 min. net from Summit to Carlisle on an easier allowance of 55 min.

From Summit to Beattock the respective times were 10 min. 20 sec. (from pass) and 12 min. 25 sec. (from start), with very cautious descents of the bank; Beattock to Wamphray, passed at 64½ and 60 m.ph.,

Among miscellaneous runs received from correspondents, there are two in particular over this section that call for mention. One of the newest Pickersgill superheated 4-4-0's—No. 78—with a 52-axle load weighing 377 tons empty and 400 tons full, also on the 10 a.m. from Glasgow, passed Lamington from Symington in

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7 min. 38 sec., though checked by signal; ran thence to Elvanfoot in 14 min. 50 sec., and on to Summit in 5 min. 10 sec., the last ¼-mile of the climb being taken at 30 m.p.h. Summit to Beattock, with the usual very moderate downhill speeds, took 10 min. 2 sec.; Beattock to Locherbie 14 min. 14 sec.; Lockerbie to Kirtlebridge 10 min. 35 sec.; Kirtlebridge to Gretna 9 min. 12 sec.; Gretna to Rockliffe 4 min. 23 sec., with a maximum of 71 m.p.h.; and Rockliffe to Carlisle, finishing very smartly, 3 min. 55 sec.—total 52 min. 23 sec. for the 49·7 miles from Summit, and one second over 80 min. from Symington, ½-min. gained on the previous section meant a total of 4 min. recovered by engine from Beattock.

Between Edinburgh and Glasgow the two competing routes bear no comparison for difficulty, the Caledonian having far the worst of it, although the "Caley," loads are usually the lighter. A correspondent sends details of a trip on the 4.55 p.m. from Edinburgh, wherein non-superheated McIntosh 4-4-0 No. 936 had a train of 185 tons gross. Merchiston, 1·2 miles, was passed in 3 min. 5 sec.; after 2 miles level start the line rises at about 1 in 140 for 6 miles, but Currie Hill, 5·5

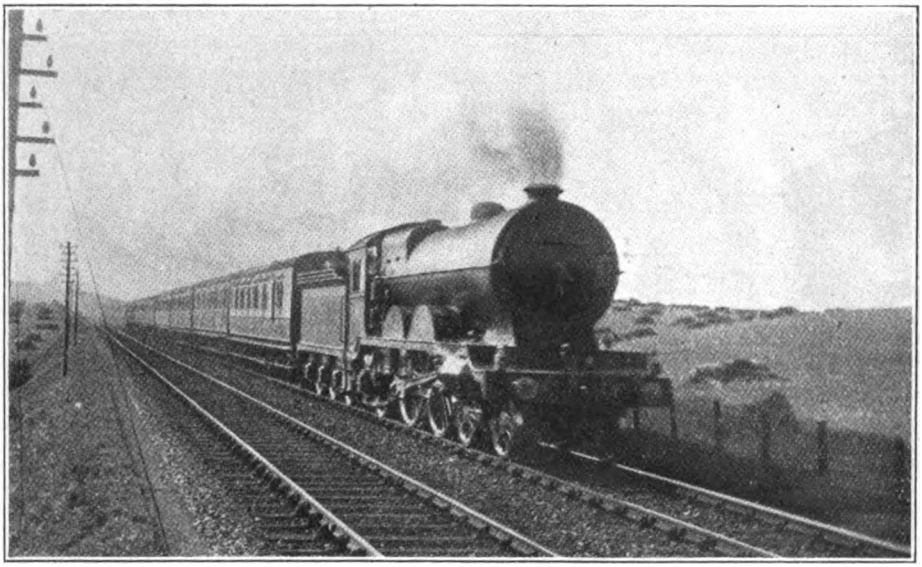

Photo.] NORTH BRITISH RAILWAY. [*Tom M. L. Neish.*

Aberdeen–Edinburgh express (with through G.N.S.R. coach from Elgin), near St. Fort.
4-4-2 locomotive, No. 874, "Dunedin."

or 78½ min. net. Smart running on another occasion was made by the "Cardean" class 4-6-0 No. 906 on the 1.45 p.m. express from Glasgow to Manchester and Liverpool, with a 305-ton train; from Beattock, Wamphray, 5·2 miles, was passed in 6¼ min. (a very good start, this), and Lockerbie reached in 15 min. 35 sec.; while from Lockerbie Ecclefechan was breasted in 9½ min., Kirtlebridge in 12 min. 40 sec., Gretna in 21½ min., Rockliffe in 26 min., and Carlisle was reached in 31 min. 10 sec. The latter time included a slight p.w.r. check at mile-post 14, net time from Lockerbie being about 30½ min.; miles, was passed in 8¾ min. (some excellent climbing must have been performed here), and Westcalder, 15·9 miles, in 23 min. 5 sec. (Midcalder Junction, an important timing point, from which the line is fairly level for 5 miles, was missed). For the next 7 miles the line again rises steeply, 5 miles being at 1 in 99-138; but Breich, 20·2 miles. was passed in 29 min., Shotts, 25·8 miles (the summit point at Benhar was also missed) in 36 min. 50 sec., Omoa, 30·6 miles, in 43 min. 35 sec., and Holytown, 33·1 miles, was reached in 47 min. 40 sec. Severe signal checks were experienced at Breich and

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Omoa, so that net time was probably less than 45 min., although the train is allowed 49 min. From Holytown to Glasgow the 13·1 miles were run in 18 min. 40 sec., despite slight signal delays beyond Eglinton Street, and a severe slack to cross-over at Newton—say, 18 min. net. This was very satisfactory work over a hard road.

For particulars of recent running over the rival North British route I am indebted entirely to correspondents. This course is virtually level throughout, save for the 1 in 45 descent from Cowlairs into Queen Street Station at Glasgow. On the westbound journey superheated 4-4-0's Nos. 416, 414 and 412, named *Ellangowan*, *Dugald Dalgetty* and *Laird o'Monkbarns* respectively had to deal with gross train-loads of 280, 310 and 360 tons on the 60-min. trip from Haymarket to Glasgow. Ratho, 7 miles, was passed in 10 min. 31 and 49, and 11 min. 20 sec.; Linlithgow, 16·4 miles, in 20 min. 19 sec., 21 min. 22 sec. and 22 min. 18 sec.; and Polmont, 21·1 miles, in 25 min. 28 sec., 27 min. 1 sec. and 28¼ min. *Ellangowan* was now badly checked for p.w. repairs, so that the times to Falkirk, 24·3 miles, were 29 min. 58 sec., 30 min. 14 sec., and 31 min. 31 sec.; to Castlecary, 30·6 miles, 36 min. 27 and 24 sec. and 38 min. 10 sec.; to Lenzie, 39·9 miles, 46 min. 41 and 12 sec. and 47 min. 42 sec.; and to Cowlairs, 44·6 miles, 53 min. 51 and 56 sec. (*Dugald Dalgetty* was slightly checked by signal here) and 52 min. 47 sec. *Laird o'Monkbarns* had thus done much the fastest running at the finish, passing Lenzie at 63 m.p.h., but spoiled the effect of it by a super-cautious descent of Cowlairs bank, whereby the final 1·5 miles took as much as 6 min. 3 sec.; 58 min. 50 sec. was the total time on this run, but it should not have been more than 57¾ min. at most for the 46·1 miles. *Dugald Dalgetty* took 58 min. 57 sec., or 58½ min. net, and *Ellangowan* 58 min. 54 sec., or 57½ min net. On the two last-mentioned runs the respective speeds at Ratho were 55 and 58 m.p.h., at Polmont 61 m.p.h. by *Ellangowan* and at Falkirk 64 by *Dugald Dalgetty*, while the former reached 64 at Dullatur and was still doing 62 at Lenzie.

In the reverse direction No. 413, *Caleb Balderstone*, had an unusually heavy train of 46 axles, taring 344 tons and weighing gross fully 370 tons, and was, as usual, banked in rear to Cowlairs, the first 1·5 miles being negotiated in 5 min. 45 sec. The 4·7 miles from there to Lenzie, passed

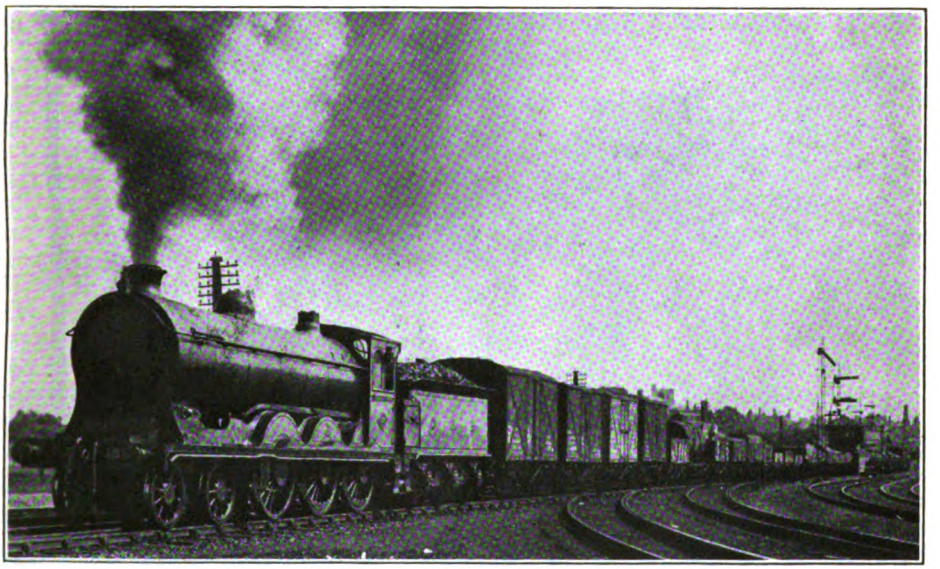

Photo.] CALEDONIAN RAILWAY. [*F. E. Mackay.*

Down express goods train. 4–6–0 locomotive (5 ft. 9 in. class) No. 180.

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at 46 m.p.h., were run in 7 min. 12 sec., the 9·3 miles thence to Castlecary (58 m.p.h.) in 10 min. 53 sec.; between the latter station and Falkirk, 6·3 miles, covered in 6 min. 41 sec., speed rose to 61 m.p.h.; the 3·2 miles from Falkirk to Polmont (59 m.p.h.) occupied 3 min. 23 sec.; the 4·7 miles on to Linlithgow (62 m.p.h.) 4 min. 55 sec.; the 5·6 miles thence to Winchburgh 6 min. 13 sec.; the 6·5 miles from there to Gogar 7 min. 19 sec.; and the last 4·3 miles to Haymarket 5 min. 17 sec.—total 57 min. 36 sec., in place of the even hour allowed.

Lastly, I have to describe a couple of runs in each direction over the terribly difficult Waverley route between Edinburgh and Carlisle. The superheated "Atlantic" No. 878, *Hazeldean*, figures in two south-bound journeys on the 9.15 a.m. London express, with tare loads of 244 and 266 tons respectively, or 255 and 280 tons full. The latter, amounting in all to 41 axles, is no mean tonnage to haul over a line boasting, among other formidable grades, 8 miles almost continuously at 1 in 70—a bank distinctly steeper than the upper 8 miles of the neighbouring and more famous Beattock bank on the Caledonian Railway. In fact, the total vertical rise on the 98¼ miles separating Edinburgh and Carlisle is no less than 1,820 ft. Portobello, three miles from Waverley, was passed in 5 min. 12 sec. and 4 min. 50 sec., and Eskbank 8 miles, in 11 min. 56 and 55 sec. Here commences the bank referred to, after a preliminary ascent of 3 miles at about 1 in 200; but Gorebridge, 12 miles, was passed in 19 min. 17 and 20 sec., and Falahill Summit, 18 miles (allowed 33 min.) in 32 min. 16 sec. and 33 min. 10 sec., minima on the 1 in 70 being 22½ and 27 m.p.h. Although with severely restrained speed all the way down, it was on the second trip that the faster descent was made to Galashiels, the 8·7 miles from Falahill to Stow taking 10 min. 37 sec. and 9 min. 35 sec., and the remaining 6·9 miles to Galashiels 8 min. 31 and 5 sec.—total 51 min. 24 sec. and 50 min. 50 sec. The short runs of 3·7 and 3·4 miles respectively from Galashiels to Melrose and Melrose to St. Boswell's occupied 6 min. 43 and 0 sec., and 6 min. 59 and 55 sec. respectively, allowed 7 min. to "clear," and 7 min. to the stop. On the first run the loss of the Kelso portion at St. Boswell's reduced the load to 195 tons; on the second trip load remained unchanged.

Photo.] LONDON & NORTH WESTERN RAILWAY. [*F. E. Mackay.*

Anglo-Scottish express. 2-4-0 locomotives Nos. 1678 "Airey" and 2189 "Avon."

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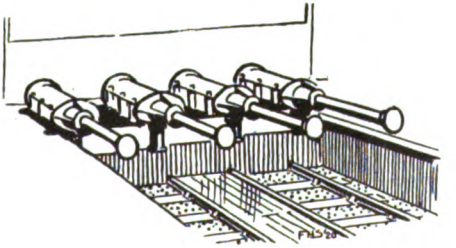
From St. Boswell's the 12·3 undulating miles to Hawick were run in 17 min. 40 and 0 sec., start to stop, allowed 18 min. Both trains were assisted in rear for a short distance from the start at Hawick, from which station there is an unbroken climb of 10·8 miles to Whitrope, of which 7 miles are at 1 in 75–80; Stobs, 3·9 miles, was passed in 9 min. 24 and 55 sec.; Shankend, 7 miles, in 15 min. 18 sec. and 16½ min.; and Whitrope Box in 22¾ min. and 24 min. 55 sec. (allowed 25 min.), at minimum rates of 25 and 26 m.p.h. The rest of the journey is easy, though with but little scope for speed: the 2·2 miles from Whitrope to Riccarton took 3 min. 35 sec. on both runs; the 8·1 miles on to Newcastleton 9 min. 40 and 10 sec.; the 7·6 miles thence to Penton 9 min. 4 and 50 sec. (there was a slack near Penton on the latter run); the 7 miles forward to Longtown in 7 min. 53 and 50 sec.; and the final 9·8 miles into Carlisle 12 min. 28 and 5 sec.—total 65 min. 25 sec. and 67 min. 25 sec. (66¾ min. net) for the 45·3 miles from Hawick. Allowance in this case is 68 min., so that on both runs *Hazeldean* had time well in hand all the way.

Going North the same engine made a much better show with a 280-ton train of 41-axle formation than No. 903, *Cock o' the North*, with a 215-ton train of 30 axles only, although both engines were running to time. Out of Carlisle they passed Harker, 4·4 miles, in 7 min. 40 sec. and 9 min. 7 sec., Longtown, 9·6 miles, in 12 min. 50 sec. and 14 min. 45 sec.; Penton, 16·6 miles, in 21 min. and 23 min. 25 sec., and reached Newcastleton, 24·2 miles, in 32 min. 10 sec. and 33 min. 27 sec. (allowed 34 min. to "clear"). From here to Whitrope is an unbroken ascent, the central portion of which consists of over 7½ miles at 1 in 75, with 1¾ miles at 1 in 80-90 to conclude (also as bad a bank, this, as the Caledonian from Beattock); Steele Road, 4·6 miles, was passed in 11 min. 5 sec. and 10 min. 46 sec.; Riccarton, 8·1 miles, in 19 min. 18 and 25 sec.; and Whitrope, 10·3 miles, in 23 min. 55 and 53 sec., speed in the latter case being 25 m.p.h. sustained. The 10·8 miles from Whitrope to Hawick were completed in 13 min. 55 sec. and 15 min. 12 sec., the second time including a p.w.r. check. Total times from Newcastleton to Hawick were therefore 37 min. 50 sec. and 39 min. 5 sec. (37¾ min. net)—allowed 38 min. From Hawick to St. Boswell's the start-to-stop times were 17¼ and 17¾ min.; thence to Melrose 6 min. 25 and 53 sec.; and from there to Galashiels 6 min. 20 and 11 sec.; the respective allowances being 18·7 and 7 min. From Galashiels to Falahill the climb is the easiest of the four great banks on this route—it runs from 1 in 99 to 1 in 200, and averages mostly 1 in 150. Up this incline the two engines passed Stow, 6·8 miles, in 12 min. 50 and 13 sec.; Fountainhall, 10·9 miles, in 18 min. 10 sec. and 17 min. 6 sec.; and Falahill Summit, 15·5 miles, in 25 min. and 23 min. 38 sec. (a really fine effort, this, on the part of *Cock o' the North*, 25 min. being allowed). From the summit the 6 miles to Gorebridge were spun off in 6 min. 35 and 51 sec.; the 9 miles on to Portobello in 11 min. 5 sec. and 10 min. 46 sec.; and the last 3 miles into Waverley in 4¾ min. on each run—total 47 min. 25 sec. and 45 min. 55 sec. from Galashiels. For this run the allowance was then 47 min., but has since been increased to 48 min. As regards other Scottish railways, I hope shortly to add to my records on the Glasgow and South Western Railway, and to publish them, with some Highland runs, later on in the year.



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Train Control on the North British Railway.

APART from a degree of control working in particular areas on one or two other railways, the North British is, as yet, the only Scottish company which has adopted train control on a systematic basis. In many respects it was, too, a pioneer in this method of regulating goods and mineral traffic, and since its inauguration on a relatively small scale in 1913, the equipment and control working as a whole have been developed very considerably, including also several special features.

The first control office was located at Portobello, and was opened in August, 1913, mainly for the purpose of regulating mineral traffic on the "New Lothian Lines," then newly opened. The equipment then installed, while it served its purpose, was found somewhat unsuitable for development, and in May, 1916, a new control office was opened at Waverley station, Edinburgh, in the Southern Divisional Superintendent's Office, to which the Portobello staff was removed, new telephone and other equipment being provided, designed to permit of the whole of the Division being brought within its scope.

Meanwhile, a Western District Control Office had been opened at Coatbridge in October, 1914, and arrangements made for a Northern District Control office, though, owing to the intervention of the war, it was not until November, 1920, that this was brought into operation, the headquarters being at Burntisland.

These three control offices now, between them, provide for the control of goods and mineral traffic throughout the system, the Southern district combining the old Southern and Central Divisions. The former embraced the lines from Carlisle to Kilnknowe Junction, situated about a mile north of Galashiels, and also the Berwickshire line up to Chirnside, including all branch lines south of Galashiels, while the latter, the Central District, included lines running north from Kilnknowe Junction and Berwick, up to and including Ratho station, the Kirkliston and Port Edgar branches and Dalmeny. The present Southern district combines all these lines, representing about 330 miles of track. The Western Division links up with the Southern Division at Ratho, and extends to Helensburgh in the West, including, of course, all sections within the Glasgow area, representing about 360 miles of line. The Northern Division covers all the northern sections, including the important Fife coal areas, the track mileage being about 320.

The Southern Division is, from its situation, the most congested, as all the main lines from north, east and west converge on Edinburgh, and it is necessary, therefore, for all through trains from the northern and western districts to the southern and eastern and *vice versa* to pass through, while a large number of trains either take up or leave traffic at the important yards, such as Portobello, Niddrie West and Hardengreen. In addition, numerous fish trains coming from the north and west pass through the area, and as these trains are necessarily given precedence over ordinary goods trains, the result is that the lines are frequently occupied to the detriment of goods and mineral train working. The control has, therefore, to keep a very close grip on all movements to ensure that every available margin is utilised to advantage.

Each of the control offices, in addition to a complete system of telephones, is provided with a diagram board, on which is painted a plan of the lines in the district, showing plainly the running lines and connections as well as sidings, together with the wagon capacity of all refuge and running loops and certain storage sidings, and the location of all signal cabins, water columns and turntables. The progress and position of the trains are indicated on the board by pegs which are shifted from point to point in accordance with the movement of the trains as reported by telephone to the controllers. The movable

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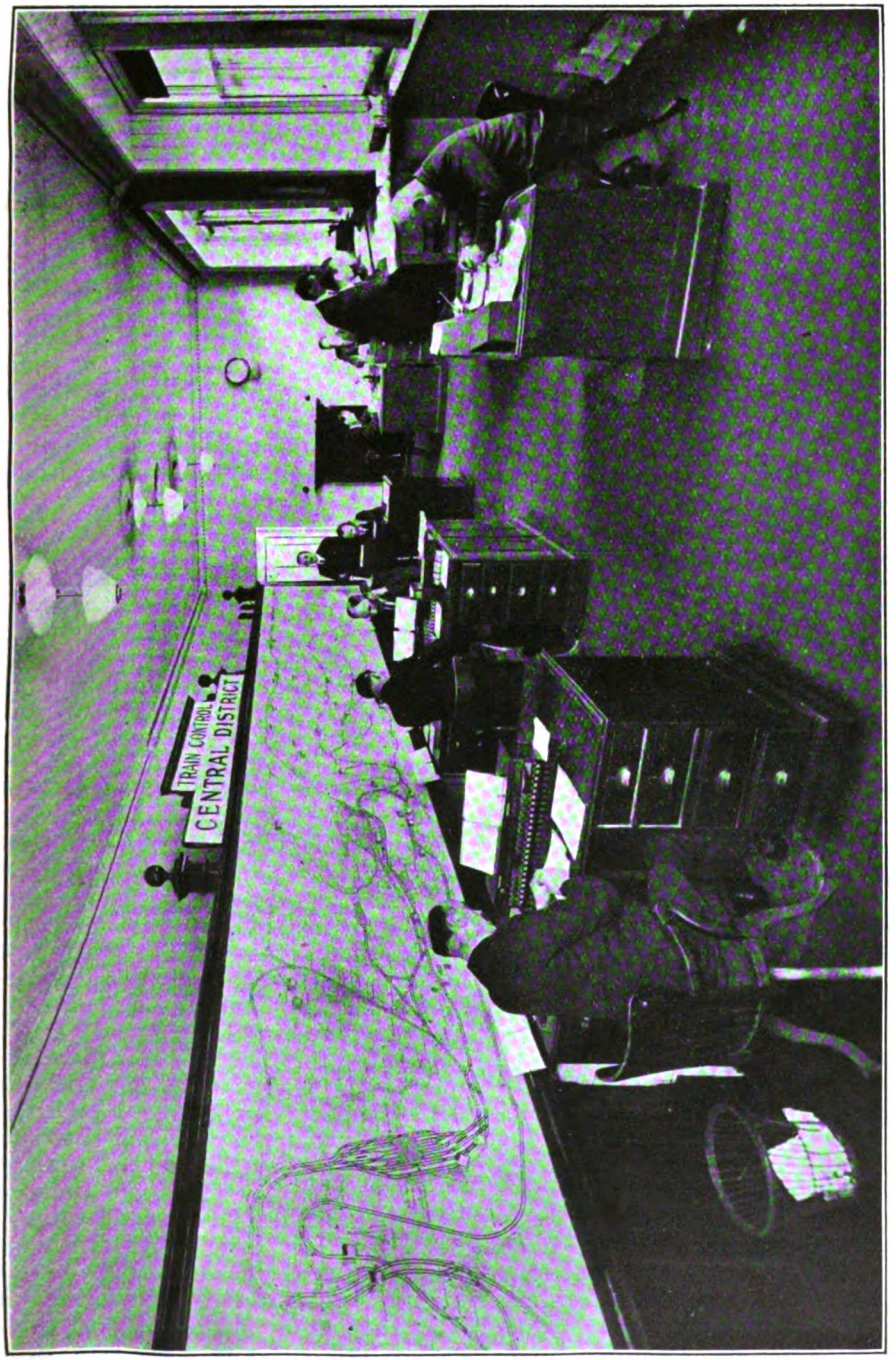

CENTRAL CONTROL OFFICE, EDINBURGH.

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pegs are constructed as shown, the head portion taking the form of a brass slide, in which a small coloured Xylonite tablet is pushed, this bearing the starting time of the train and also the point at which the journey commences and that at which it ends. The peg is pushed through a square white ivorine tablet bearing the number of the locomotive, its class and the shed at which it is stationed.

A table explaining the meanings of the various colours, signs and other indications is painted in bold characters upon the board, and reference is also made to the colours adopted on the train pegs. These are as follows :—

Express braked goods trains ...	... Red.
,, goods trains, Class A...	... Pink.
,, ,, ,, Class B...	... Blue.
Through goods or mineral trains	... Orange.
Ordinary ,, ,, ,, ,,	... White.
Ballast trains	... Brown.

Passenger lines are shown by means of heavy black lines, whilst goods running lines and loops are indicated by means of lighter lines. Joint and foreign lines are shown in distinct colours. Refuge loops and sidings are indicated by means of circles coloured green, each containing a number showing the wagon standage capacity. Circles of a neutral tint are adopted to indicate storage sidings and loops, each circle showing the capacity. Private works and sidings are marked by the letter " P " within a circle. Coloured shapes are used for indicating passenger station platforms, signal-boxes, engine sheds, ground cabins, water columns, &c., letters being added in the case of a ground frame thus, G.F. Engine turntables are indicated by means of a circle with short lines radiating therefrom, the diameter of the table being given. The running lines are marked " Up " and " Down " everywhere, and, in short, all the details of the accommodation and facilities are admirably set out.

The face of the board is painted a light cream colour, on which the black lines and coloured lettering and shapes show up very clearly. Where connections are made with other districts, a number of spare peg holes are provided, and in these pegs are placed whilst trains passing out of and returning to the area are absent therefrom. The pegs and tickets are kept in a special desk arranged for easy reference, and the engine tablets are kept separately in a drawer.

The method of working is as follows. A peg bearing particulars of the train upon it, is taken from the desk by the locomotive relief controller and on receipt of an advice from the locomotive depôt a disc bearing the number, class and shed of the engine that will be used is also taken out and the peg passed through it. This peg is then handed to the section controller, who prepares a train card according to the class of train. When the train leaves, particulars are telephoned by the control reporters, or, alternatively, by the yard staff at the various points, and full details of the load, &c., of the train are then entered on the card. The train is followed along the line as it proceeds, being pegged on the board and also entered on the card, the peg being placed at the starting point on the control board when the train leaves and moved forward thereafter as reported. Through trains are only reported from certain specified signal cabins, but local trains are reported from every point of call, the particulars stating the number of wagons attached and detached, times of arrival and departure, number of minutes late, and so forth. An entry at the bottom of the card shows the time the train started and finished its journey, the cards being passed on from one section controller to the next as the train proceeds.

These operations necessarily involve a number of qualified assistants, and a complete and systematic telephone system is required, and it will be of interest to consider one of the District Control offices in detail, that at Coatbridge, headquarters of the Western district, being selected as representative of the others.

The control office at Coatbridge is operated by a chief controller and three shifts of train controllers, 10 in each shift, with a deputy chief controller to each shift of eight hours, these manipulating traffic generally. In addition, there are relief controllers for guards and locomotive crews, and they arrange reliefs for men likely to exceed their daily turn of duty, and issue orders to the depôts for the provision of guards and brake vans for all special trains, a note being kept of the times that the men are out.

The control diagram board measures

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COATBRIDGE CONTROL OFFICE.

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42 ft. in length. The controllers sit in front of the board at five desks, two at each desk. In the centre of the room, desk and seating accommodation is provided for the deputy chief controller and his clerk, and others for the guards and locomotive relief controllers and their clerks. The staff further includes a supervisor of plant (goods and mineral wagon stock), with four assistant clerks, whose duty it is to attend to the details of the wagon distribution system. Further, there is a shipping department, the staff of which looks after the movement of all traffic between the collieries and the shipping ports.

A list is compiled of all booked trains, this being prepared from particulars available daily of all trains from other districts and those within the area itself, provision being made for special trains. The deputy chief controller, on receipt of reports from the other districts concerned, frames the workings for the control shifts. If it is found that the trains running on the ordinary booked schedule cannot clear the traffic in hand in accordance with the regular traffic working, special trains are worked into the day's programme, the arrangements being based on the movements of the regular goods, mineral and passenger trains, and the specials put on the line at times when the margins are greatest. The depôts within the district report what guards are available and the locomotive depôts what engines are at their disposal. Three reports are made daily to the control office in respect of spare guards, engines and engine crews available for special train working.

In setting up the telephone system as many of the existing telephone circuits as were found capable of carrying the additional volume of work required for control purposes were utilised, being extended as required to a given point, considered to be most central for the purposes of collection. Additional circuits were provided on the busier sections and these are also omnibus to allow for interworking. In the Western area exchanges were placed at Bathgate, Cowlairs and Polmont, and trunk lines run to the control room at Coatbridge. The advantage gained by using these exchanges is that economy is effected in the saving of telephone lines. Had the exchange system not been used it would have been necessary to run each circuit direct to the control, whereas under the exchange system a few trunk lines take the place of a large number of omnibus circuit lines.

Another advantage from a commercial point of view is that the controller receives all his work through one trunk instead of through a number of omnibus circuits, the work of regulating the flow of information being directed by the exchange clerk. It should be noted that the exchange clerks, in addition to the mechanical duty of switching, have to regulate the trunk traffic and the telephone traffic from the outlying circuit stations. This has the advantage of saving the time of signalmen, and also prevents the lines from being held up. The circuits are so arranged on the exchange board that each trunk is utilised to work a particular section. In practice the exchange system is found to operate most satisfactorily, and the maintenance cost is light.

The omnibus circuits are led into the Bathgate Exchange and these are divided into two districts worked by two controllers; 20 omnibus circuits are led into Cowlairs Exchange, this being divided into three districts worked by two controllers. Telephone circuits in the Coatbridge district lead direct into the control room. There are 12 omnibus circuits, grouped on the control board, so that each controller has his particular section circuits in front of him. All the telephone circuit lines are of copper and revolved so as to eliminate line induction from neighbouring circuits. Special attention has been given to testing facilities, test boxes being provided at the junctions of linemen's section.

The telephones used are of 1,000 ohms polarised relay battery type, with the ordinary ringing for omnibus working—that is, from cabin to cabin—performed by means of code signals with the ordinary key on the telephone, a special key for ringing the control exchanges being connected to each telephone. The control boards were specially designed by Mr. W. Wood, electrical engineer to the company, the main object in view being compactness, efficiency and simplicity of working.

In the control room at Coatbridge there are 15 boards to feed from the main distributing board. These are divided up

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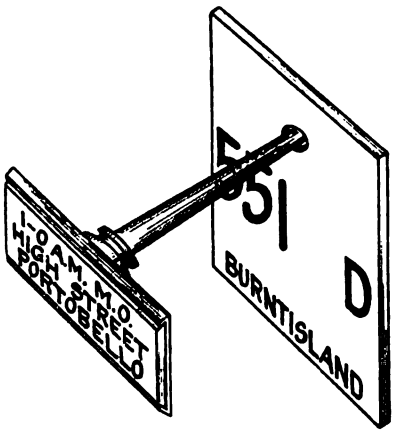

MOVABLE PEG USED ON CONTROL BOARD.

so that the Deputy Chief Controller, his assistant, the guards' relief and the locomotive relief and the wagon staff have all the circuits, the other boards having the particular circuits applicable to the district over which the controller operates, and also of the circuits operated by the controller on either side, so that if one controller requires to leave his table the controller at the next table can attend to the circuit. During quiet periods and for Sunday working, the advantage of the multiple system is apparent.

The controllers do not use the ordinary head set and breast-plate type of receiver and transmitter, as this is found inconvenient when rising from the table and attending to the shifting of the pegs on the diagram board. A special combination set has been designed to take the place of the usual apparatus. The receiver is fixed directly behind the transmitter and a short horn conveys the sound waves to the transmitter or microphone. This compact form of apparatus, known as the monophone, is adjusted for low speaking and has proved very successful..

The headquarters control, in the offices of the operating superintendent at Waverley station, Edinburgh, constitutes a supervisory control in direct telephonic communication with the district controls. Its operations are, comparatively speaking, of a limited kind, dealing with main line traffic only, the control board being relegated to the movement of through trains of certain classes and limited in number. It consists of three rooms, allocated as follows :—

(1) Chief of control and goods train working.
(2) Control room proper.
(3) Goods plant distribution.

The board shows the main lines only, Edinburgh to Dundee, Perth, Stirling, Glasgow, Berwick and Carlisle. It is used only for classes "A" and "B" trains conveying merchandise, including perishable traffic, live-stock, &c. Three classes in all are reported, viz., "A," "B" and "Through." Headquarters only concern themselves with the important trains, the others being left to the local or district controls.

Sheets are kept for every 24 hours, all trains enumerated thereon being reported from district controls to headquarters and entered at specified points on the sheets, trains being also reported by telephone and wire from points outside the control area. The headings on the sheets are as follows :

(1) No.	(2) Trains— (starting and passing points.)	(3) Times Booked, Actual, Late.	(4) Loads. Booked, Actual, Underload.	(5) Remarks.

Each train is given a number to simplify the reporting between district control and headquarters. All starting and passing points and destinations are entered in column 2 of the sheet. The booked times are set out in type and actual times are entered in pencil, the word "time" being written when booked and actual times agree. Similarly, the words "minutes late" are entered in column 3. The actual loads of the trains are filled in in pencil in column 4, similarly to the train times, and where the booked and actual loads agree, the booked figures are repeated. The load shown in type is calculated for the particular train and the class of engine ordinarily working that train. If a lower class of engine is used the load is reduced accordingly and headquarters control advised of the fact. The sheet is then marked with the letter indicating the class of

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engine actually employed, in the remarks column thus :—

11.30 a.m. Berwick to Meadows Sidings.

	Bkd. time.	Actual time.	Late mins.	Bkd. load.	Actual load.	Under.	Eng. class.
Berwick depart	11.30	11.30	Time	55	45	10	C

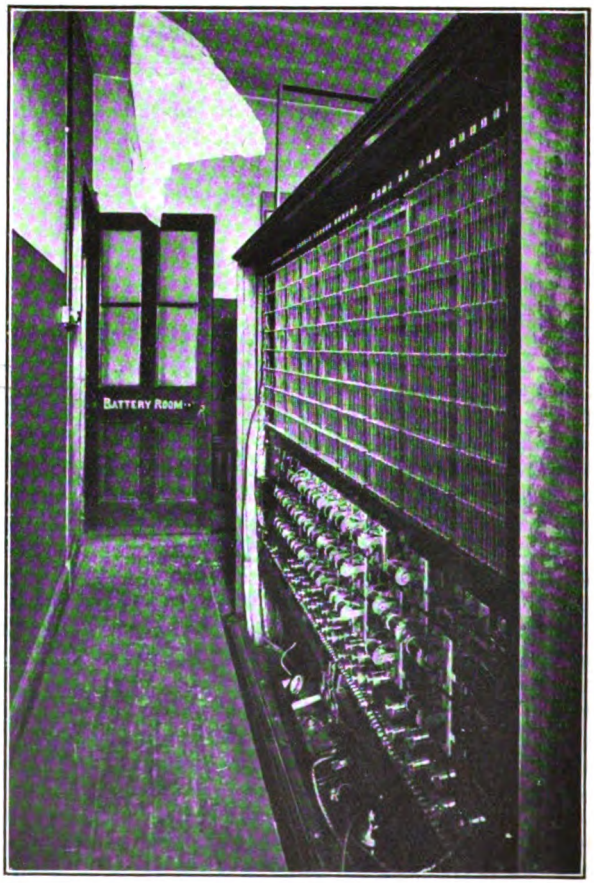
which, being analysed, means that the train left punctually, but owing to the fact that an inferior class of engine was used, viz., "C" instead of "B," the load had to be reduced from 55 to 45 wagons. The class "B" engine (non-superheated) has cylinders 18½ in. by 26 in., whilst in superheated form the cylinders are 19½ in. by 26 in., its full load being then 55 wagons and brake. The class "C" is an 18-in. by 26-in. engine, and its full load is 45 wagons and brake. The column headed "Remarks" provides a means of entering up the explanations of late running, &c. Headquarters control follows up delays with the district concerned immediately by telephone, and much correspondence and time is thereby saved.

A record of special trains running on important main lines is kept, and headquarters control is consulted before any special trains are put on. The timings of such trains are decided by headquarters. If the timing asked for by the district control is considered unsuitable by headquarters, for some reason or other, alternative times are provided, these being as nearly as possible similar to those asked for by the district control.

At 6 a.m., 10.30 a.m., and 8.30 p.m. each day, reports reach headquarters from all districts, the information being utilised for the preparation of special sheets headed "Traffic Working Report." The locomotive running superintendent's department at Cowlairs reports to headquarters the number of spare engines available, and the times at which they are free, such engines being those that are available or to spare after booked workings have been covered.

Another sheet records all special passenger, fish or empty carriage trains running throughout the district and indicates the "booking on" time of the trainmen. Where possible, steps are taken to ensure that an engine and crew are used to work back a coaching train or a through goods train for the dual purpose of obtaining a double load for the engine and avoiding the use of passenger guards on other than their legitimate work.

In an extensive system of train control the need arises for a large number of forms and other documents, and the North



TELEPHONE DISTRIBUTING BOARD, COATBRIDGE CONTROL OFFICE, NORTH BRITISH RAILWAY.

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British control system requires about 50, as follows:—

Form.	Headings under which particulars are entered.
C.C.3	Record of empties supplied to and loads removed from collieries.
C.C.6	Traffic waiting removal.
C.C.4	Shipment traffic record.
C.C.5	Traffic waiting special service.
C.C.11	Record of opening orders for shipment coal and of the working forward of the coal from the collieries to the port.
977	Daily wagon report.
C.C.27A.. ..	Summary of daily wagon reports for day, 19 .
C.C.31A— Coatbridge (Control) depôt) ..	Summary of daily wagon reports for day
C.C.12C ..	Wagon summary—Western District Collieries—Control Office, Coatbridge.
C C 12Cc — Sections 1 & 2	Record of requests for supplies of empty wagons for collieries, &c., and reports from stations or cabins as to number of empty wagons supplied to each colliery.
C.C.12C— Section 3 ..	Ditto.
Section 4 ..	Ditto.
C.C.17E— Section 5 ..	Ditto.
C.C.17F— Section 6 & 7	Record of requests for supplies of empty wagons for collieries, &c., and reports from ststions or cabins as to number of empty wagons supplied to each colliery.
C.C.17G— Section 8 & 9	Ditto.
187E	Daily return, goods train stock (Central district).
C.C.33E ..	Summary of North British stock despatched during 24 hours from Western to other North British districts or "foreign" lines.
C.C.1	Record of spare and relief enginemen available and how utilized.
C.C.42	Record of spare and relief guards available and how utilized.
C.C.21	Train message.

Some of the forms mentioned are connected with the distribution of rolling-stock, goods and passenger respectively. Circulars are issued to the staff setting forth the distribution arrangements of both classes of vehicles and the work performed is wholly under the supervision of the operating superintendent. The new arrangements were brought into force in May, 1915, when the appointment of Plant (*i.e.*, goods train stock) Superintendent was abolished. The distribution is carried out by the controls in the districts wherein these have been installed, while in the other divisions of the line, where control methods are not in force. the distribution is supervised by the District Traffic Superintendents.

As already mentioned, the control system was extended to the Northern District in November, 1920, attached to the District Operating Superintendent's Office at Burntisland, thus affording the same traffic working facilities to all the main and branch lines north of the Forth, including Stirling, Alloa, Perth and Dundee, as well as the Fife coalfields and shipping ports on the Fife coast. These include Alloa, Charlestown, Burntisland, Kirkcaldy, Methil and Tayport, also embracing Dundee Docks and Perth Harbour. It is here the full advantage of the system is apparent in transporting the output from the Fife coalfields to the docks, and dealing with the heavy traffic passing to and from the north of Scotland, being in touch with the Great North of Scotland Railway at Aberdeen, and the Highland Railway at Perth.

A modified system of train control is in operation between Dundee and Kinnaber Junction, at which point trains pass on to the Caledonian line, over which running powers are exercised to Aberdeen. The area of the Northern Division covers 400 miles of track comprising large marshalling yards at Townhill, Thornton, Dundee, Kirkland, Kelty and Inverkeithing. The telephones in the Control Office are arranged similarly to those in the Western and Southern Control Offices, with the additional improvement that, instead of "eye-ball" indicators to obtain attention, small electric lights for each circuit are substituted, thus making the working absolutely silent.

Close touch is maintained with the various collieries, yards and docks by the control and district offices, and through them by the headquarters staff. Special vehicles, such as rulley wagons, gondolas, &c., are controlled entirely and their movement specially followed by the headquarters control staff.

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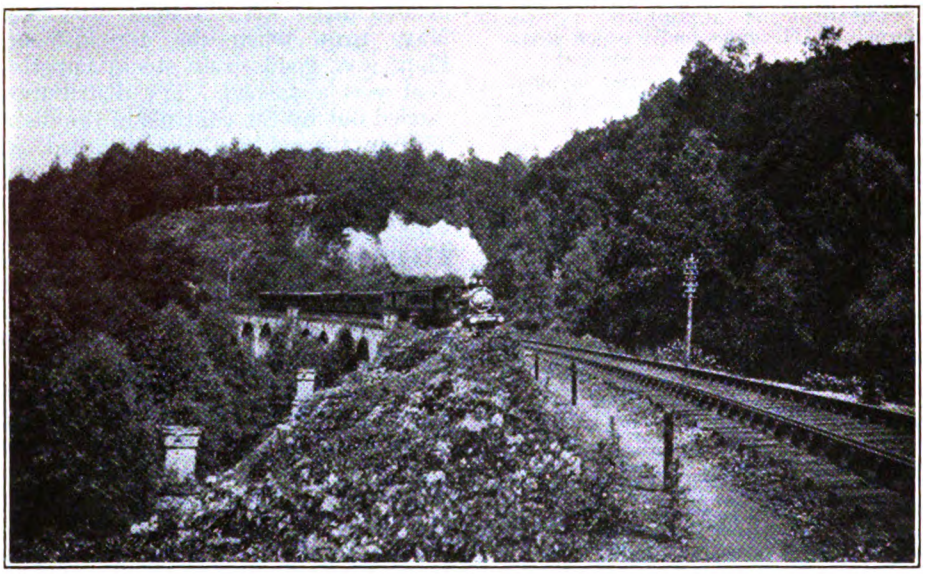

IN THE PASS OF KILLIECRANKIE.

The Highland Railway under the Grouping Scheme.

THERE are few railways possessing greater scenic, tourist, sporting and traffic interests than the Highland, and it is not strange that anyone who has once visited the Highlands of Scotland is ever ready to renew acquaintance therewith, while to the student of railway operation its lines and engineering works, locomotives and rolling-stock, train services and traffic are worthy of the closest attention. It is, indeed, a line which presents many features of absorbing interest, while it adds 279 miles, reckoning direct railway mileage only, to the "traffic backbone" provided by the London and North Western Railway from London to Carlisle, with the Midland as a slightly longer alternative from London or from Bristol, and the Caledonian Railway from Carlisle to Perth, a total distance of 450 miles from the Metropolis by the former route. In fact, the Highland Railway, although it provides the "Farthest North" section of this main route through England and Scotland, giving the longest possible continuous journey entirely within the sphere of any one of the four groups authorised by the Railways Act of 1921, is by no means an insignificant partner in this great association. It ranks third among the Scottish Railway Companies in respect of total length of railway—506 miles—and of the route from London to Wick it contributes 279 miles, as compared with the London and North Western contribution of 299 miles (Midland 308 miles, or from Bristol 316 miles), while the Caledonian share is 151 miles.

The position of the Highland under the grouping scheme is, therefore, a somewhat peculiar one, in that its mileage contribution is by no means a small one, while the tourist traffic for which it specially caters mostly originates some considerable distance away from its own territory, a large proportion, indeed, coming from London itself. Thus, while the Highland may be concerned in the great tourist traffic of the summer months to the extent

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of as much of its direct mileage of 279 as may be involved, taking into account also the traffic which passes on to its branches and to the old main line between Aviemore and Inverness, via Forres and Nairn, a by no means small share of this traffic involves travel over the lines of other companies coming into the same group to the extent of 450 miles or even more. In addition, a considerable amount of traffic of the same class passes on to the Highland system via Perth, and via Keith or Elgin, from the North British, Great North of Scotland and other railways which will comprise the North Eastern, Eastern, and East Scottish group, including the important traffic from London via the East Coast route. Furthermore, there is a large amount of traffic from Edinburgh and Glasgow to Highland stations, via Perth, by both the North British and Caledonian routes, and through coaches are run in connection with both of these companies, and sleeping cars are run between Inverness and Glasgow (Caledonian Railway).

Perth is one of the most interesting and, in some respects, most complicated traffic centres in Scotland, and this is largely due to the elaborate systems of inter-connections between the Caledonian and North British Railways and the Highland trains. It may be suggested, indeed, that an important improvement which may result under grouping conditions will be that Perth will cease to be the "frontier" station that it is at present (though it must always maintain its importance as a traffic centre and junction station), many of the delays and complexities which now exist being obviated by through working of Caledonian and Highland trains north and south of Perth, probably as through trains, instead of through carriages only, between Glasgow and Edinburgh and Inverness. Necessarily, even under grouping conditions, there must also be close association with the North British Railway, for almost if not quite as much interchange traffic is due to North British and Highland interconnections, but as that will involve two separate groups it will be sufficient to anticipate inter-working on the lines suggested between the Highland and the Caledonian as members of the same group. The point is, however, that the by no means unimportant mileage contribution of the Highland Railway in regard to the considerable volume of tourist traffic which will be conveyed over the lengthy mileage within the same group, emphasises the importance of this, the "Farthest North" British railway. It must be remembered, also, that although through vehicles are run only to a limited extent between the lines north and south of Inverness, the northern main line between Inverness and Wick and Thurso involves a distance of 168 miles, and has important traffic value.

It is true that, compared with the other constituent companies within the group, the Highland carries, for part of the year, traffic of relatively small volume, owing to the fact that so much of its mileage is through the sparsely-populated and mountainous parts of Scotland, and it is only during the summer months that its traffic reaches at all considerable proportions. But the fact that at such times the principal services to the Highlands, not only from London but also from other towns in England, and from Edinburgh and Glasgow and various parts of Scotland, necessitate the running of trains over Druimuachdar Summit (1,484 ft. above sea-level), and several other steep mountain gradients, of weights which are difficult to manipulate on the relatively easy gradients of the railways which operate the same trains south of Perth, indicates that during the tourist season the Highland traffic is important. A chief consideration, indeed, is that so much of this traffic involves the payment per passenger of amounts which, even at excursion rates, require the expenditure of from £1 upwards. Therefore, assuming that only 300,000 passengers transfer on to the Highland Railway in the course of twelve months from connecting railways at Perth, by far the larger proportion would have paid fares amounting to several pounds, of which the railways in association take a considerable share, owing to the relatively lengthy mileage which so many of the journeys concerned entail.

It is sometimes assumed that the Highland is a long straggling main line in continuation of the great traffic routes which centre upon Perth from the south. To some extent this is so, owing to the fact that it necessarily winds about

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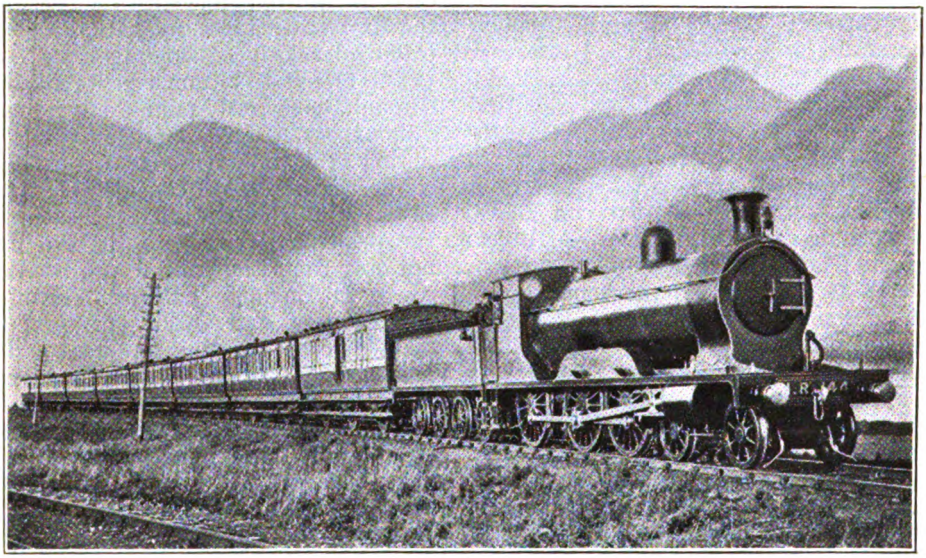
considerably in order to find a suitable pathway through the mountainous districts, and that its lines follow the rivers and roads which in pre-railway days governed the location of towns and villages. From the traffic point of view, however, this is an incorrect estimate, seeing that the Highland provides the most direct and frequently the only convenient route in regard to a very large part of northern Scotland. On the goods side, too, while there again its traffic totals may appear somewhat inferior to those of the railways

miles over other railway companies' metals, in addition to from 120 to 279 miles on the Highland Railway itself. Livestock traffic, again, is a considerable item, and in 1920 no less than 687,441 head were despatched from the Highland system, an appreciable proportion, in this case also, being handed over to other railways. Timber also is a great feature in the merchandise traffic, while the fact that the Highland serves several naval bases is productive of important traffic.

For working traffic over the 506 miles



CROSSING THE GRAMPIANS.

4-6-0 locomotive ("Castle" class) on Inverness-Perth train.

to be associated with it, in view of the country traversed it is of sufficient importance to justify consideration. For example, wherever the Highland Railway is within convenient reach of the coast, and especially where it serves fishing ports (which, incidentally, are fairly numerous along the coast lines of the counties of Inverness, Ross, Caithness and Sutherland), the fish traffic receives special consideration, and large numbers of special fish trains are run during the fishing season. Moreover, most of these trains are destined for towns a long distance from Perth, including Manchester and Liverpool, Leeds and Bradford, Birmingham, and even London, thus involving several hundred

of the Highland system, covering also several small light and leased and worked railways, there are now in use 50 locomotives of the 4-6-0 type, including Mr. Cumming's latest passenger and goods designs, 80 4-4-0 locomotives, besides 12 ordinary 0-6-0 goods locomotives, and three engines of the 2-4-0 type. There are also 28 tank engines, of which eight are large and powerful locomotives of the 0-6-4 type. The company owns 800 passenger train vehicles, and these include two sleeping cars which run between Inverness and Glasgow nightly, and 10 Post Office and sorting vans. Merchandise and mineral vehicles are relatively few, numbering only 2,718, but a great deal of

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traffic passes on to the Highland Railway in wagons belonging to other companies.

A word must also be said in regard to the hotels owned by the company. The Highland Railway Company is one of the owners of Perth joint station, including the well-known hotel there, while the Station Hotel adjoining Inverness station ranks as the finest in the "Capital of the Highlands." At Strathpeffer Spa, too, the Highland Company own a beautifully situated and deservedly popular hotel, largely patronised by visitors to the Spa. There are also equally well equipped and managed hotels at Dornoch (the "Paradise of the Golfer") and Kyle of Lochalsh.

It remains to be seen to what extent the traffic conditions and working methods of the Highland Railway will be changed when grouping is completed, and it will probably be some years before any great alterations become noticeable. But, meanwhile, the attractions of the Highlands will no doubt bring, year by year, the accustomed numbers of visitors from London, other parts of England, and from southern Scotland, and with attractive facilities, generous excursion arrangements, and the revival of tourist tickets, permitting of reasonable variation of route and break of journey at every place of interest, the fortunes of the Highland Railway, which received so great a setback during the war period, notwithstanding the exceptional services rendered in national interests during that time, will once again be on the up grade. Much will depend upon the way in which the Highland section of the new group is fed by the associated lines, but, as indicated above, its traffic is well worthy of cultivation and in itself possesses considerable monetary value per passenger conveyed, so that there should be every inducement for the group management to do all that is practicable to develop traffic between England and southern Scotland, and the wonderfully attractive Highland districts served by our "Farthest North" railway.

As a result of grouping, there should, indeed, be very important developments in the near future for the territory covered by the existing Highland Railway. The old "Highland" should offer a grand field for exploitation when finally linked up with the Midland and West Coast English lines. No district can offer such unique attractions as the Highlands of Scotland for the sportsman or tourist who wishes to shoot, fish, golf, or otherwise enjoy the healthy and invigorating air of this "land of brown heath and shaggy wood." During last summer, Inverness was not only the "Capital of the Highlands," but for a time the virtual "Capital of the Empire," the venue of important Cabinet meetings, and, as a contemporary put it, the "Whitehall of the Highlands." In fact, the situation was even more notable, for not only was the Premier in the vicinity for several weeks, but His Majesty the King was also staying in Highland territory, and was thus able to give his personal attention to urgent national affairs.

It follows, therefore, that the English railway companies who propose to absorb the "Highland" under the Railways Act will appreciate the very valuable asset they are acquiring in taking over a line which possesses unique attractions as a holiday resort, and which is capable of enormous possibilities in the way of traffic development. Indeed, it may be confidently stated that the Highland Railway is *par excellence* the British holiday line, and under a well organised system of advertising by the English companies in association, one can readily foresee the immediate effect this is bound to have in making better known the super qualities of the beautiful Highlands of Scotland.

Furthermore, as the question of utilising the abundant water power resources of Scotland becomes more acute, many places in Highland territory may be converted to busy industrial centres. Mr. A. Newlands, Chief Engineer to the Highland Company, has contributed papers to several of the leading technical societies and institutions emphasising this aspect, pointing out the tremendous water power potentialities of the Scottish mountain areas, and, before many years have passed some part, at least, of these schemes must attain realisation; and when that occurs the Highland Railway will be very largely concerned.

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THE RAILWAY PORTRAIT GALLERY.

Photo.] MR. R. L. WEDGWOOD, C.B., C.M.G. [*Elliott & Fry.*

General Manager, North Eastern Railway.

APPOINTED to succeed Sir A. Kaye Butterworth, from January 1, 1922, as General Manager, North Eastern Railway. Mr. R. L. Wedgwood, C.B., C.M.G., has been Deputy General Manager since 1919, in combination with his responsibilities as Chief Goods Manager (appointed 1911) and those of Passenger Manager, added in February 1914, on the retirement of Mr. Philip Burtt. He joined N.E.R. service in 1896 and was employed in the Dock Superintendent's Office at West Hartlepool from 1898, becoming Assistant Dock Superintendent. He was then transferred to York as an Assistant to the General Traffic Manager, and in 1902 became District Superintendent at Middlesbrough. In 1904, he returned to York as Secretary, but was shortly after, at his own request, re-transferred to the traffic department. In 1905 he was apppinted Northern Division Goods Manager, and in October, 1911, became Assistant Goods Manager. During the war, Mr. Wedgwood acted as D.A.D.R.T. in the Transport Establishment in France, with the rank of Major R. E.; in July 1915 he was transferred to the Ministry of Munitions, with the temporary rank of Lieut.-Colonel. In 1916 he became Director of Docks in France, with the temporary rank of Brig.-General. In 1917 he received the C.M.G., and in 1918 the C.B. He also holds several foreign decorations. In 1920 Mr. Wedgwood was Chairman of the Goods Managers' Conference of the Railway Clearing House.

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EXTERIOR OF PRINCES STREET STATION, EDINBURGH; CALEDONIAN RAILWAY.

Notable Railway Stations and their Traffic.

PRINCES STREET, EDINBURGH, CALEDONIAN RAILWAY.

By J. FRANCIS.

SITUATED at the west end of Edinburgh's most famous thoroughfare, Princes Street, at the junction of several other main roads, adjacent to the business and residential districts and convenient for access to the industrial areas of the Scottish capital, the Caledonian Railway Company's terminal station, known as Edinburgh (Princes Street), ranks as one of the chief railway stations in Scotland. The combination of a great hotel, itself one of the leading hostelries in Edinburgh, and frequently the scene of municipal and other functions attended by dignitaries and leading personalities in the civic and industrial life of the city, and the Lothian Road goods depôt alongside, together render Princes Street station notable in regard to the area covered, while the hotel and the station proper possess considerable architectural interest. Princes Street station is intimately concerned with the important main line traffic to and from all the chief centres of industrial, holiday and tourist interest in England and Scotland, while large numbers of travellers, under season or zone ticket arrangements, make regular daily use of the station, in addition to the large volume of ordinary and excursion ticket traffic which is dealt with. The capital of Scotland has, in recent years, developed a heavy suburban residential traffic; the season ticket travel between Edinburgh and Glasgow being by no means a small factor, and the industrial

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and dock activities of the Port of Leith, Granton and other places on the Firth of Forth account for a great deal of local traffic, of which the Caledonian Railway obtains a substantial share, and all of which centres upon Princes Street station.

This station was described in the RAILWAY MAGAZINE for July, 1901, and the principal facts of historical interest may be briefly summarised. The foundation stone of the original station was laid April 9, 1849, with Masonic honours, " by the Grand Lodge of Scotland, his Grace the Duke of Atholl, Grand Master Mason, assisted by the other officers of the Grand Lodge, in the presence of the Lord Provost and magistrates of the City of Edinburgh, and the directors of the Caledonian Railway." The plans provided for a building " on a scale that would do no discredit to the magnificence of the great City of Edinburgh," but these were never fulfilled, and traffic was inaugurated on February 15, 1848, with a temporary station some 180 ft. in length and 54 ft. wide. The site was then in Lothian Road, a short distance away from Princes Street itself, and now forms a part of the principal goods depôt of the company in Edinburgh, and it was not until May 2, 1870, that the temporary station was superseded by the first Princes Street station, substantially on the site now occupied, but again of a temporary character. This erection was about 500 ft. long and 100 ft. wide, and does not seem to have been particularly imposing, seeing that Sir William Acworth in his book on " The Railways of Scotland," published in 1890, described it as " a wooden shanty." Arrangements were, however, already in progress for the erection of premises commensurate with the importance of Edinburgh as a traffic centre and worthy of the Caledonian Railway as one of the leading railway systems of Scotland, and work on this was accelerated in consequence of an outbreak of fire in 1890, which partially destroyed the second " temporary " station.

INTERIOR VIEW, FROM THE LEFT.

The estimated cost of the new station was £120,000, and by the beginning of 1893 a considerable part was in regular use. Even then, however, while the station proper was very much as it is now, the hotel had yet to be added. In fact, at the time our previous article, above mentioned, was written, the hotel was still in process of erection. Work was begun in 1899, and the hotel brought into use on December 21, 1903.

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Princes Street station is, as already indicated, admirably situated from the point of view of convenience of access to the central districts of Edinburgh. The principal tramway routes pass its doors, while it is located at the junction of several important thoroughfares, notably, Princes Street, Lothian Road and Queensferry Street. From the architect's and engineer's point of view it occupies a somewhat awkward site, being fitted into the angle between Lothian Road and Rutland Street and Square. At the apex of the wedge, fronting upon Princes Street, however, an imposing effect is realised, the hotel and station entrance arcades matching one another, and the hotel buildings forming an appropriate stone superstructure. Along Lothian Road, too, the architectural scheme is continued, and as viewed so that both frontage and the Lothian Road façade can be seen, the effect is imposing and artistic.

Approaching the station from Princes Street the apex frontage includes three sections—the central and left-hand belonging to the hotel, while that to the right constitutes a wide arcade entrance to the station itself. Hotel premises complete the frontage above and extend some distance alongside Lothian Road, then giving place to a series of offices, including, on the first floor, those of Mr. Alexander Fulton, District Traffic Superintendent, and Mr. D. McLellan, District Engineer. Therefore, while from Princes Street the station presents a symmetrical appearance, it is somewhat peculiarly shaped inside. Originally there was an entrance roadway and cab road within an enclosing wall along Lothian Road, but this has all been incorporated in the hotel premises, while cab access is fully provided for from Rutland Street on the other side of the station,

INTERIOR VIEW, FROM THE RIGHT.

more especially as all platforms are used as required for either arrival or departure, but those adjacent to the cab road are selected as far as possible for main line trains.

The railway diverges angularly with reference to Lothian Road, and, therefore, the platforms are of varying length, as they are brought as far as possible towards the main circulating area without restricting freedom of movement therein. The booking office is placed in the middle of the circulating area, as it widens out from the arcade entrance. It is approximately oval in shape, with nine booking windows, allocated for particular routes or destinations, and used as required to suit traffic

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needs. On either side of the circulating area are various station premises, mostly on the left hand on entering, those to the right extending only as far as the cab entrance from Rutland Street.

Passing through the tiled entrance arcade, on the left, is a hair-dressing saloon, accessible also from the reception hall of the hotel, and opposite to it is a cab order office. The walls of the arcade bear a tasteful arrangement of high-grade pictorial posters. Following the left-hand side of the circulating area a series of station premises may be noted. Passing one of two entrances to the hotel from the station itself the first office to be considered is Messrs. Williamson's steamship and railway ticket office, in connection also with the American Express Company, and where foreign exchange and other tourist agency business is transacted. Next is the postal telegraph office with a train arrival slate outside. Adjoining is the lost property and inquiry office, and next to that is the stationmaster's public inquiry office, where seats are reserved and other public needs met. The stationmaster's private office is above this, with projecting windows, so that he can see over the whole of the circulating area. This section is surmounted by a three-faced clock. The general refreshment room and a large bookstall complete this range of offices, &c., which are characterised by their neat and artistic cabinet and glass work. The bookstall curves round to meet the station wall, along which may be noted: ladies' first and third-class waiting rooms, gentlemen's first-class waiting room, an entrance to the station direct from Lothian Road, with a tobacco stall on one side of it, general waiting room, lavatories, an entrance to the company's offices above, and a covered passage leading to the commodious parcels office, the main public entrance to which is in Lothian Road.

On the right of the circulating area as it opens out from the arcade entrance may be noted a first-class refreshment room (with oyster bar), second-class refreshment room, restaurant and dining rooms, left luggage office, and two telephone call offices. Round the corner towards the cab entrance are porters' rooms, &c. Except for the booking office and a sweetmeat and fruit kiosk, the whole of the circulating area is left clear—an important point seeing that at times the station has to deal with passengers in large numbers. At one end of the booking office is a small tobacco stall.

It will be seen, therefore, that the station is well equipped from the refreshment and restaurant point of view, while the needs of travellers are taken fully into account and all required offices are most conveniently arranged. At the end of each platform are large frames adapted to receive boards bearing the names of principal stations on the various routes served, together with the departure times of the trains. Nos. 1 and 2, on either side of the cab road, are generally treated as open platforms, all others being closed except to ticket-holders. As will be seen from the illustrations, they are of varying lengths, ranging from 433 to 700 ft.

The signalling at Princes Street is somewhat peculiar to modern ideas, due to the fact that the present equipment was designed when the station was built, and intended re-signalling and modernisation from the traffic working point of view has been delayed owing to the war, but for which the station would have been as up-to-date in this respect as it is in others. Alongside No. 1 platform is a series of carriage sidings and a connection giving access to the Dewar Place electric power station of the Edinburgh Corporation, which is supplied with coal, &c., during the night via the passenger station. On the other side is the Lothian Road goods depôt, its tracks making connection with the main lines about half-a-mile away from the station.

Approaching Princes Street there are six lines, two leading to the goods depôt, a siding line on the up side which connects with the shunting line, up and down main lines, and a second down line. Outer home signals—two for each of the down main lines—are placed on a signal bridge immediately to the west of Morrison Street Station and the shunting yard. Approaching trains, therefore, encounter these outer home signals for the respective lines and connections—one for the north side of the station and the other for the south side of the station—outside shunting limits, and before either of these outer home signals can be cleared one of the

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platform signals upon the big gantry spanning the station at its outer end must be "off." Apart from these outer home signals all station work is controlled by this bridge of signals. For each platform there is therefore a complete set of signals corresponding in every case, except that No. 4 has two starting signals, one above the other, as this platform can be left by either of two connections. Apart from the siding and shunting arms, the usual equipment for each line is an up starting signal on one post and three down signals controlling the entrance of trains to the various docks on another post.

The topmost signal on the down or arrival post is for trains arriving by No. 1 down main line, while the second signal is for arrivals by No. 2 down main line. The third signal, which is fish-tailed and ringed, is a precaution signal applying to either of the down main lines, and is only cleared when the dock is empty to the buffer end. It consequently gives the driver approaching the station the necessary information as to whether the dock into which he is running is entirely clear. In addition to the semaphore signals mentioned, each of the docks with the exception of No. 1 is equipped with a ground disc signal which is the starting signal for trains leaving the docks.

Traffic from Edinburgh divides into two sections—that in the Leith direction diverging from the main line at Dalry Junction, about half-a-mile from Princes Street, and that which follows the main line for at least two stations. The former includes the Leith and Barnton trains, together with the north main line trains which, after passing Dalry Road Station, diverge to join the North British Railway at Haymarket West Junction, thence using the North British Railway, by virtue of running powers, to Larbert. The other group includes the Glasgow stopping and express trains, main line and other trains to Carstairs, &c., and the Balerno branch trains which diverge at Slateford, and in some cases rejoin the main line at Ravelrig Junction.

GENERAL VIEW OF CIRCULATING AREA.

Altogether about 120 trains depart from and 125 arrive on a normal day at Princes Street Station, though during the summer, and especially at the local holidays, these are largely increased. There is a good amount of long-distance main line traffic, but the great volume is residential and suburban traffic. A considerable part of this is conducted under season ticket arrangements, but a special

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feature of Caledonian traffic in Edinburgh is the system of weekly zone tickets, permitting of unlimited journeys with tickets issued weekly and on a distance basis. The arrangements are very generous, and it is not surprising that the issue of zone tickets reaches very large totals in the course of a year. The following schedule of zone ticket rates from Princes Street will, no doubt, give rise to envious thoughts on the part of readers in less favoured districts:

WEEKLY ZONE TICKET RATES.

EDINBURGH (PRINCES STREET) with

	First.	Third.
	s. d.	s. d.
Balerno or Curriehill	5 6	4 0
Juniper Green	4 10	3 3
Colinton or Kingsknowe ...	4 0	2 9
Slateford	2 6	1 9
Merchiston	2 0	1 4
Murrayfield	2 0	1 4
Barnton	3 9	2 4
Leith	2 6	1 9
Leith and Barnton	4 9	3 1

Moreover, there is very little workmen's traffic in Edinburgh, the purely workers' trains consisting of five in either direction between Princes Street station and Granton Gas Works, which convey workers to and from the Corporation Gas Works and another works in the neighbourhood. The ordinary morning and evening services carry a few odd holders of workers' tickets, but on most of the suburban routes radiating from Princes Street the regular passengers are almost wholly of the professional and business classes, as the district served, particularly on the Balerno, Barnton and Leith sections, are the most desirable residential areas within easy hail of the capital. During the summer months, Davidson's Mains and Barnton stations are very popular for day and half-day trips, serving, as they do, places on the shores of the Firth of Forth. In fact, it is by no means unusual for these two stations to deal with as many as 13,000 passengers in a single day. The Balerno line, which forms the key to the Pentland Hills, carries large numbers of passengers who make use of that picturesque but extremely "corkscrew-like" line for walking expeditions and picnics in the hill country.

Prior to the allocation of traffic during the war period, now happily at an end, Princes Street station dealt with a large proportion of the total London-Edinburgh traffic, and it is already regaining much of its pre-war favour in this respect. In the case of Liverpool and Manchester traffic, the Caledonian route always attracted the major portion. There are also valuable services between Edinburgh and Moffat, Peebles and Lanark; and through carriages are run daily to Stranraer, on the Portpatrick and Wigtownshire Joint Railway.

Northwards, the connections to Stirling, Callandar, Oban, Gleneagles, Crieff and to the Highland Railway via Perth often necessitate long and heavy trains, while between Glasgow and Edinburgh there is a steady volume of daily traffic all the year round, considerable numbers of Glasgow business men residing in Edinburgh and travelling to and fro daily. At holiday periods through trains are also run from Princes Street to Gourock and Wemyss Bay, for the Clyde resorts, and to Balloch for Loch Lomond. Such trains are, in fact, regularly run at the "month ends" when so many Scottish families are travelling to and from the favourite holiday resorts and centres on the Clyde coast. Altogether, about 2¼ million passengers are booked annually at Princes Street station, while it is safe to estimate the numbers using it at from 5 to 6 millions per annum.

Parcels, milk, horse-box, motor-car and other traffic is, of course, dealt with at Princes Street as at other large stations. Much of the country milk traffic is, however, handled at Merchiston, the first station out, though that for the Leith line is transferred at Princes Street. Edinburgh, too, has its share of mail traffic, sections of principal mail trains working to and from Princes Street.

A few remarks may now be made in regard to the train services dealt with at Princes Street, and though those of the summer months may possess greater interest, it will be best to consider the present winter facilities in preference, in that they represent the standard arrangements, while it is probable that next summer the services will represent considerable improvements upon those of 1921.

Via the main line, traffic is divided between (1) trains in the Carstairs direction, including the south expresses, and

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trains for Lanark, Biggar, Peebles, Moffat, Dumfries, Carlisle or other destinations on those routes. (2) Glasgow trains, traversing the same route as far as Midcalder Junction, 11 miles from Princes Street; (3) a few trains which terminate at Midcalder, Fauldhouse or other intermediate stations on either of these routes; (4) and the Balerno line trains which serve Merchiston and Slateford stations, and in a few instances rejoin the main line at Ravelrig Junction and serve one or two main line stations beyond. The principal express trains, however, perform no suburban work within the Edinburgh area, except for an occasional call at one of the residential stations to provide fast facilities where the demand is justified. This feature is, however, peculiarly noticeable in the case of certain of the Edinburgh and Glasgow expresses, not for traffic into and out of Edinburgh but for the benefit of Glasgow business people residing at Edinburgh district suburban stations. Thus, the principal morning express to Glasgow, leaving Princes Street at 8.50 a.m., calls at Merchiston and also at Midcalder, in addition to the usual stop at Holytown, though it is yet required to reach the Central Station in Glasgow at 10.0 a.m. Similarly, on Saturdays the 1.35 p.m. from Glasgow calls at Shotts, Westcalder and Merchiston, while the 5.5 p.m. (not Saturdays) and 6.45 p.m. serve Shotts, Fauldhouse, Westcalder, Midcalder and Merchiston. All these, as well as the other expresses between Edinburgh and Glasgow, include a Pullman buffet car.

The Edinburgh and Glasgow expresses are designed to give substantially corresponding services in each direction, for throughout the day there is a steady interchange of passengers between the political and industrial capital cities of Scotland. Thus, the 8.50 a.m. from Princes Street (70 minutes, 3 stops) is balanced by the 8.40 a.m. from Glasgow Central (70 minutes, 1 stop); there are 70 minutes (one stop) expresses at 11.0 a.m. from each end; similarly at 1.35 p.m. there are non-stop expresses either way in 65 minutes, except on Saturdays, when each train is given two or three intermediate stops and corresponding additional time; the 3.45 p.m. from Princes Street takes 70 minutes, with one stop, and the 4.0 p.m. from Glasgow, 72 minutes, with two stops, the second at Merchiston, for Edinburgh residents; the

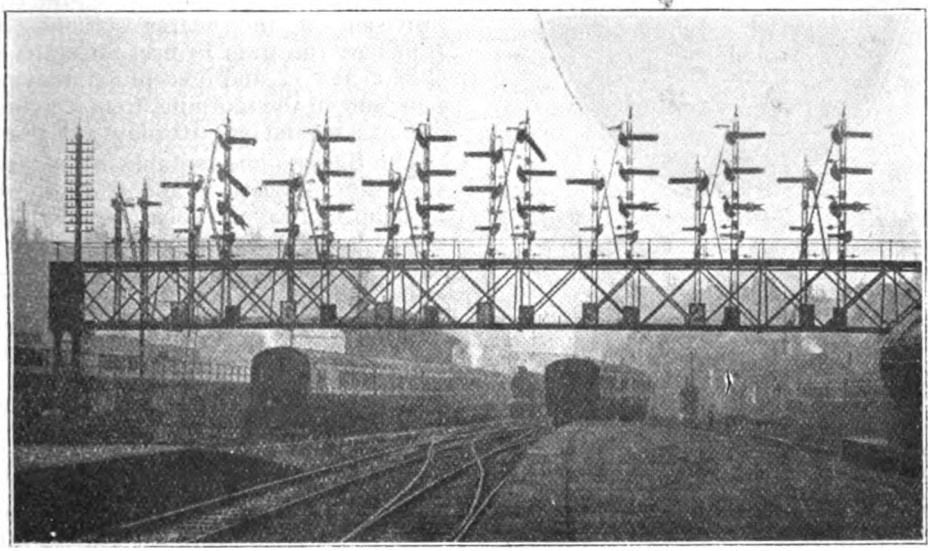

Photo.] [*J. F. Gairns.*

BRIDGE OF SIGNALS SHOWING CHARACTERISTIC FEATURES.

(*a*) No. 2 Down Main to No. 7 platform cleared throughout. (*b*) No. 1 Down Main line clear for shunting back into No. 4 platform.

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Photo.] [*J. Moffat.*

MR. ALEXANDER FULTON,
District Traffic Superintendent, Edinburgh.

4.55 p.m. from Princes Street is another 70 minute train (one stop), balancing the 5.5 p.m. from Glasgow as a semi-fast, both being " Saturdays excepted " trains ; and the 7.5 from Edinburgh (70 minutes, one stop), balances the 6.45 p.m. semi-fast from Glasgow. Besides these, there is another express from Glasgow at 9.50 a.m. (70 minutes, one stop), and as all these trains include a Pullman car, the 6.20 a.m. stopping train from Edinburgh is similarly provided for balancing purposes and to furnish breakfasts to early travellers. There are also frequent stopping or semi-fast trains making the Edinburgh-Glasgow journey throughout, and several of these provide semi-fast local facilities for Edinburgh business people residing a few stations out. This applies principally in the outward direction from Princes Street by the 3.55, 6.0 and 8.5 p.m. Glasgow trains, with the 8.44 and 10.10 Saturday trains which run only to Fauldhouse, but is more particularly characteristic of certain trains on the Carstairs route, notably the 2.0 p.m. (Saturdays only), 3.50, 5.20 and 5.48 p.m. trains, with the 10.0 p.m. on Saturdays, which is more or less fast as far as Midcalder. Also by the 8.15 a.m. from Carstairs in the morning.

There is not, however, a great demand for fast suburban trains on these routes, and the chief necessity is that, by the stopping Carstairs, Glasgow and Balerno route trains, Merchiston and Slateford, and, to a lesser degree, Kingsknowe, Currie Hill and Midcalder, are given a reasonable number of trains to meet the requirements of (1) morning residential traffic into town ; (2) mid-day outward and return traffic for lunch, as many residents go home for the mid-day meal ; (3) the Saturday afternoon return traffic, and (4) the corresponding return traffic on other days. To complete the traffic provision of the nearer stations, local trains are run from Princes Street to Merchiston at 1.11 and (except Saturdays) 6.8 p.m. and in the morning from Merchiston at 8.41 a.m. and on Saturdays at 2.48 p.m.

The Balerno line, notable for its " corkscrew-like " location, and really more of a light railway in character, while it gives few evidences as it pursues its sinuous course along the picturesque valley of the Water of Leith (several important paper mills and other works are served by this line) that it does so, also serves important residential districts, notably Currie, Juniper Green, and Colinton. Four-wheeled coaches only are allowed upon it, and for this traffic three sets of eight essentially modern four-wheeled coaches (with spare vehicles for strengthening to 11 at busy periods) have recently been constructed by Mr. Pickersgill, Locomotive Superintendent at St. Rollox works. Except that they are four-wheelers, these vehicles accord with present Caledonian standards for suburban rolling-stock, having high elliptical roofs, safety-catch door locks, electric light, steam heating, &c., as in the case of modern bogie suburban carriages. The engines used are 0-4-4 tanks, with 4 ft. 10 in. coupled wheels. These trains stop at all stations, and therefore assist to meet the needs of Merchiston and Slateford.

Via Dalry Road, the suburban traffic is mainly served by the Leith and Barnton trains. For these, bogie or six-wheeled rolling-stock is used as convenient, while locomotives of any type may be employed. All trains call at each station, and as they serve Dalry Road, Murrayfield and Craigleith, Branton Road and Newhaven, all

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popular residential districts, in common, they together provide a very frequent service throughout the day.

So much for the suburban and residential traffic, to which, in view of the large extent to which it figures at Princes Street, pride of place has been given. Attention must, however, now be given to the main line services other than those to and from Glasgow. The first main line departure to the south is the 6.30 a.m. connection with a stopping train from Glasgow to Carlisle. This is followed by the 8.33 a.m. for Carstairs. Next comes the historic 10.0 a.m. London express consisting of through corridor carriages and a restaurant car from Edinburgh, not infrequently heavy enough to require running as a separate train to Carlisle, but ordinarily attached to the train from Glasgow at Strawfrank Junction. Following this is the 10.10 a.m. to Carstairs, a corresponding train for Liverpool and Manchester. The 12.50 p.m. (except Saturdays) works through to Lanark, but the 1.7 p.m. on Saturdays connects with a Glasgow train at Carstairs. The 1.30 p.m. is the Edinburgh portion of the mid-day Glasgow-London express, with restaurant cars from both places, and is attached at Carstairs to the Glasgow section. At 2.0 p.m. on Saturdays there is another through train for Lanark. The 3.50 p.m. is the afternoon connection to Carlisle, Liverpool and Manchester, and it also carries a portion for Lanark. The 4.45 p.m. (not Saturdays) is divided at Dolphinton Junction, the first part passing Carstairs and running direct to Symington, while the second part works through to Lanark. The 5.20 p.m. is similarly divided at Dolphinton Junction, the first part running to Symington and the second terminating at Carstairs, but on Saturdays working through to Peebles. The 5.48 p.m. is a stopping train to Carstairs. At 6.35 p.m. the special postal express leaves, attached to the main train at Symington. At 9.40 p.m. on Saturdays is an express sleeping car connection to the south via Carstairs, followed by the 10.0 p.m. "Saturdays only" train, for Carstairs. At 10.30 p.m. is the ordinary night sleeping car train for London (Saturdays excepted), conveying also through portions for Liverpool and Manchester, which go on by the 12.0 midnight train from Carstairs. Except for the through expresses, most of these trains call at various intermediate stations, while they also give complete connections with trains from Glasgow at Carstairs.

Arrivals at Princes Street from the south may be briefly summarised: 5.30 a.m., Edinburgh section of the postal express; 7.10 a.m., sleeping car express from London, &c. (Mondays only); 8.0 a.m., the corresponding train on other days; 9.27 a.m., stopping train from Carstairs; 9.33 a.m., express from Muirkirk at 7.20 a.m.; 12.45 p.m., from Carlisle at 9.5 a.m.; 3.58 p.m. from Carstairs 4.10 p.m., restaurant car express from the south; 5.31 p.m. from Lanark at 4.13 p.m.; 6.6, 6.30 amd 6.52 p.m., restaurant car expresses from the south; 7.33 p.m. (7.39 on Saturdays) from Carstairs; and 9.26, 10.10 and 11.2 p.m., restaurant car expresses from the south.

It now only remains to consider the north expresses from Princes Street, which travel over the North British Rail-

Photo.] [*Lafayette Ltd.*

MR. T. PRENTICE,
Station Superintendent, Princes Street, Edinburgh.

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way between Haymarket West Junction and Larbert. These leave Princes Street at 6.45 a.m. for Stirling; 9.25 a.m. for Perth; 11.30 a.m. for Stirling; 1.15 p.m. for Stirling (Perth on Saturdays); 4.25 p.m. for Perth, and 9.45 p.m. for Stirling (where it is combined with the 10.0 p.m. from Glasgow (Buchanan Street)) for Aberdeen. Corresponding arrivals at Princes Street are: 10.14 and 11.7 a.m. from Stirling; 1.52 p.m. divided at Stirling from the 9.30 a.m. ex Aberdeen; 4.46 p.m. divided at Larbert from the 11.45 a.m. ex Oban; the 7.28 and 8.20 p.m. both divided at Larbert from Aberdeen or Perth trains, and the 10.20 p.m. divided at Larbert from the 5.30 p.m. ex Oban. Most of these trains include through coaches for several destinations. Thus, the 4.25 p.m. from Princes Street regularly includes 4 for Perth, 2 for Oban, 2 for Callander and 1 for Crieff, and not infrequently these trains require to be double-headed and a considerable and valuable traffic is conveyed by them.

As in the case of most Scottish railway stations, there is very little traffic on Sundays, and that usually associated with night long-distance express trains. No local trains are run on any route, but Princes Street has to deal with the sleeping car train from the south, arriving at 8.0 a.m. the 3.50 p.m. from Perth at 5.55 p.m., the 9.40 p.m. departure for the south, and the 7.0 a.m. for Larbert and the north. There are also workmen's trains at 5.37 a.m. and 5.37 p.m. from Princes Street for employees at Granton Gasworks, with the corresponding return trains at 6.12 a.m. and 6.12 p.m.

It will be seen that Princes Street station affords abundant material of interest. It is never really quiet, except on Sundays, and the fact that it involves a station staff of upwards of 150 indicates that there is always plenty to do, and there are not many quiet moments in its single signal cabin. Besides the regular train movements, empty coaches have to be shunted to and from sidings, or from one platform to another, and engines are regularly running to and from the engine sheds at Dalry Junction. And at holiday periods and during the hours of business travel it oftentimes affords a scene of bustle and life.

As the headquarters of the Edinburgh district the offices of the district traffic superintendent and the engineer and other district officers are located at Princes Street. Mr. Alexander Fulton is District Traffic Superintendent, and to him, with Mr. Thomas Prentice, Station Superintendent, and officers of the Caledonian Railway Company, the writer is indebted for valuable assistance in the compilation of this article, and for facilities for observing the traffic working at Princes Street. Mr. Fulton entered the service of the Caledonian Railway in the District Superintendent's office at Glasgow Central station in 1884, where he spent the first six years of his service. He was transferred to the Superintendent of the Line's office at 302, Buchanan Street, Glasgow, in 1890, serving in the staff and rates departments, and was appointed Chief Rates Clerk in 1902. In 1908 he was appointed Commerical Assistant to the Superintendent of the Line. In 1910 he was appointed Assistant District Traffic Superintendent at Perth, where he remained for a year, before his appointment as District Traffic Superintendent at Edinburgh in 1911.

Mr. Thomas Prentice joined the service of the Caledonian Railway in 1883 at Douglas station, where he was employed for four years. For the next 10 years he was in the booking office at Glasgow Central station, from which office he was promoted to be Stationmaster at Yoker. He has been Stationmaster successively at Stobcross, Glasgow (Central, Low Level), Wemyss Bay, and Glasgow (Buchanan Street) prior to his appointment to be Station Superintendent at Edinburgh (Princes Street) in 1919.

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ON THE ROAD TO BRAEMAR.

Motor Road Services of the Great North of Scotland Railway

By "INDICATOR."

(Photographs by J. F. Gairns.)

THE Great North of Scotland is one of the four British companies which have wide powers in regard to road services operated in connection with the railway. In fact, while its total mileage is 334½ miles, an additional 159 miles are covered by its motor road vehicles, which number at present 34 for passenger service and 11 for goods and parcels traffic. In proportion to its total mileage and rolling-stock this represents a very considerable addition to the strictly railway part of its operations. Indeed, the Great North of Scotland Railway figures very prominently in the road traffic facilities of the districts it serves, as will be seen from the map reproduced, which suggests almost as wide a range of road services as of railway routes.

Many of the road services operated by the company are of a public utility character, and, as such, run all the year round, constituting, in fact, extensions of the railway system. On such services, some of which give two, three or more journeys daily in each direction, parcels, general merchandise, agricultural produce, &c., are conveyed in considerable quantities, constituting, in fact, organised motor services into districts which are not directly served by railways, as an improvement and development upon the old-fashioned carrier's cart. Some of these routes also possess great tourist interest and therefore require during the summer season to be amplified. Others, again, are mainly of a tourist character, and are operated only during the summer months, with perhaps an attenuated service during the rest of the year to meet local requirements. The Great North of Scotland Railway also arranges a number of tours, utilising both road and rail facilities, favourable terms being offered which have caused these to be very popular with holiday-makers desirous of touring the beautiful districts of Scotland served by the Great North system. Besides the parcels and other traffic carried by

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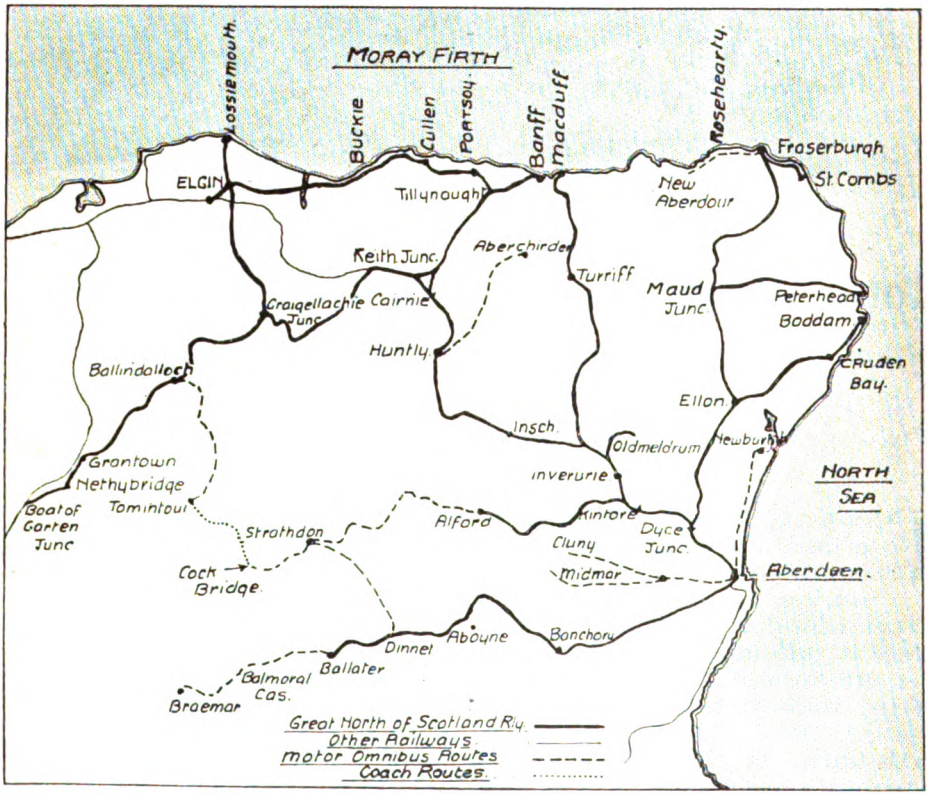
the passenger motor vehicles, the company also operates a number of goods and parcels motors to meet the goods traffic requirements of the districts served, where they demand more accommodation than can be provided on the passenger vehicles.

The goods and parcels lorries to some extent operate on regular routes, but a considerable part of their work consists of journeys arranged according to the needs of traffic collection and distribution away from the railway but within a convenient radius of the various railway stations. For example, the motor lorries are utilised for general cartage work in the neighbourhood of Aberdeen and of other principal centres on the railway, though they are not generally used for cartage purely within town limits. Daily goods services are operated for conveying general goods, coal, manure, timber, &c., between Aberdeen and Newburgh, this being one of the regular passenger road motor routes from the "Granite City;" Road lorries are also run regularly between Alford and Strathdon and between Ballindalloch, Glenlivet, and Tomintoul, these, again, being routes served also by passenger vehicles which take light goods and parcels traffic as well.

Other work done by the lorries is of a varied character according to requirements. For example, at times when certain seasonal traffic is available a lorry will be stabled at a country station for the purpose of making journeys as required within a convenient radius. In a given locality there may be a considerable amount of timber available for transport; the company would send a lorry to the nearest station so as to be available for bringing in timber as required. During the spring a considerable traffic is done in the distribution of artificial manures to farms some distance from stations, and a frequent traffic is the delivery of coal to country houses in the localities served.



G.N.S. RAILWAY SYSTEM SHOWING ROAD MOTOR ROUTES.

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Occasionally, too, the Great North of Scotland Railway combines road and rail transport by sending a loaded lorry placed on a flat truck, as far as practicable by rail, the lorry being then sent on a delivery tour during which it will also collect as its load is distributed, so that when it returns to the same or another station it has a corresponding load to be brought back to Aberdeen or other depôt to which it is attached.

It will therefore be seen that road motor transportation as organised by the Great North of Scotland Railway, possesses many features of interest, and is well worthy of study in view of the combination of general utility services by which places not directly served by rail are given regular facilities for conveyance of both passengers and goods, the heavier branches of goods transportation by road in extension of the railway arrangements and of utilising and developing these basic facilities to suit touring and pleasure requirements.

Seven routes are regularly operated by Great North of Scotland road motor vehicles. These are as follows, with the dates when they were inaugurated :—

(1) Ballater and Braemar, 16½ miles, May, 1904.

(2) Huntly and Aberchirder, 11¾ miles, May, 1905.

(3) Alford and Strathdon, 19½ miles, May, 1906.

(4) Aberdeen and Cluny, 16½ miles, September, 1906.

(5) Aberdeen and Midmar, 17 miles, November, 1906.

(6) Aberdeen and Newburgh, 15¼ miles, April, 1907.

(7) Fraserburgh and New Aberdour, 9½ miles, November, 1912.

Several of these traverse districts of considerable tourist interest, but during the summer (commenced June, 1907), a composite tour, known as the "Three Rivers Tour," is operated, and it is one of the most popular during the season. This includes travelling by "rail, coach and motor" through the valleys of the Dee, Don and Spey. Further reference will be made in due course. Goods lorry services were inaugurated in December, 1906. Between Aberdeen and Cluny and Echt, parcels lorry services are run to relieve the passenger vehicles, utilizing the chassis of some of the older passenger vehicles. It may be mentioned that the Great North of Scotland Railway conveys upwards of 20,000 tons annually of goods and merchandise traffic by its motor

GROUP OF FIVE G.N.S. RAILWAY MOTOR OMNIBUSES LOADING FOR THE 5 P.M. DEPARTURES FOR VARIOUS ROUTES FROM SCHOOLHILL STATION, ABERDEEN

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vehicles, while some 250,000 passengers are conveyed by passenger vehicles. The passenger motor vehicles used are substantially of three main classes. As the traffic has to be carried on throughout the year, and the parcels and light goods traffic is a considerable item at all times, nearly all are of single-decker type. There are, however, two motor omnibuses which have outside seats for 10 passengers arranged on the rear part of the roof, the front portion providing accommodation for 10 cwt. of luggage. The inside accommodation provides for 16 passengers and two seated beside the driver. These are used principally on the Aberdeen-Newburgh route. The standard class of vehicle has, however, no roof seats. Of these there are 14 in service, providing for two passengers seated alongside the driver, with one transverse seat for four passengers immediately behind, while the main compartment has two longitudinal seats for six passengers each. This makes a total seating accommodation for 18 passengers, while 15 cwt. of luggage can be carried on the roof. A recent addition to the fleet is a vehicle seating three passengers beside the driver, and having in the main compartment one cross seat for five passengers, with the back to the driver, also 10 cross seats for two passengers each on either side of a central passage-way and a rear seat for four passengers curving round at the entrance. Another vehicle has the interior divided into two sections, the driver being placed in an enclosed compartment at the side of the engine, no passengers being seated by him, and an additional transverse seat being provided in the body of the vehicle. For summer traffic five open char-a-bancs are in service, two for 28 passengers and three of smaller type carrying 18 passengers each. The goods stock includes eight Foden five-ton steam lorries and three Clayton five-ton steam lorries, each adapted to haul a three-ton trailer, while three petrol lorries of old type, adapted from passenger vehicles which have been superseded by later ones, are used for the special parcels services and for lighter goods traffic.

A part of the old locomotive works at Kittybrewster has been adapted to form a depôt for the motor vehicles, and here all light and running repairs are undertaken. There is a small machine shop, a tyre press and various appliances suited to the work required, together with stores. In the event of heavier repairs being necessary the vehicle is sent to the railway works at Inverurie. It may also be mentioned that all the lorries are provided with rubber tyres.

Dealing now with the various services in order, that which is perhaps best known and most popular is the one between Ballater and Braemar. During the past summer three services were operated daily in connection with Deeside trains from and to Aberdeen. The first leaving the joint station at Aberdeen at 8.5 a.m., after the arrival of the mail and sleeping car trains from London, left Ballater Station at 10.15 a.m., allowing 30 min. for transferring luggage, mails, &c., from train to omnibus and travelling via Bridge of Gairn, Abergeldie, Crathie, Inver and Bridge of Dee, reaching the Invercauld Arms Hotel at Braemar at 11.50 a.m., and terminating at the Fife Arms Hotel (a short distance beyond) 5 min. later. The second service in connection with the 10.10 train from Aberdeen left Ballater at 12.10 p.m., reaching Braemar at 1.40 p.m. On Saturdays the last service was by the 3.20 p.m. from Aberdeen, leaving Ballater at 5.15 p.m. and reaching Braemar at 6.45 p.m.; but on other week-days the corresponding service was by the 4.40 p.m. train from Aberdeen, leaving Ballater at 6.10 p.m., and reaching Braemar at 7.40 p.m. The return services left Braemar (Fife Arms Hotel) at 6.35 a.m. on Mondays, 7.45 a.m. Mondays excepted, 1.30 p.m. and 5.30 p.m. in July and August, or 4.30 p.m. in September, in each case making connections with Deeside trains at Ballater Station. During the autumn and winter months the service is naturally considerably reduced. Thus, while two services will be operated until January 7, 1922, from that date until May there will be only one in each direction in connection with the 10.10 a.m. from Aberdeen and from Braemar at 7.45 a.m.

This is one of the most popular road services in that it traverses so much of the beautiful valley of the Dee, and after passing through the royal village of Crathie, gives fine views of Balmoral Castle amidst its wonderfully picturesque

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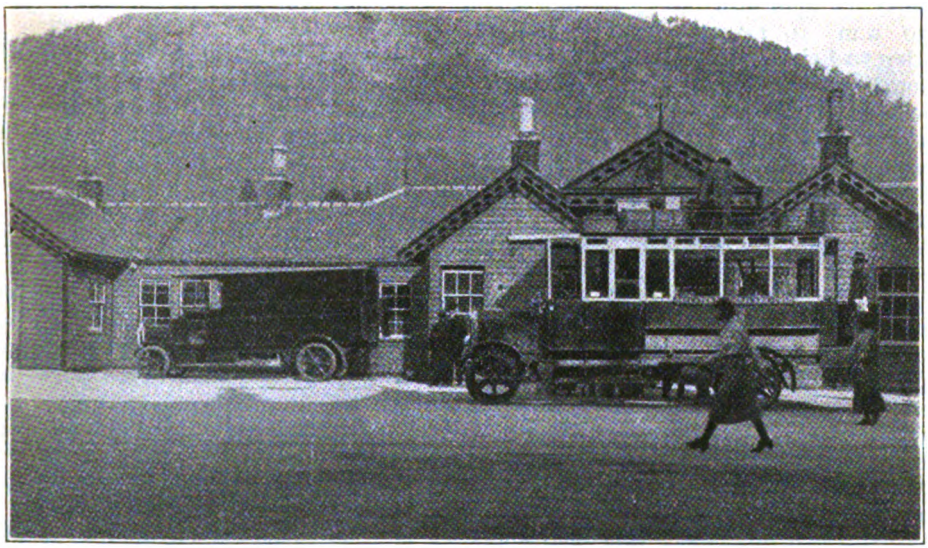
surroundings. From end to end, indeed, the route is most interesting from the scenic point of view, while Braemar, with its castle and the hill slopes surrounding it has grown into very great favour as a tourist and holiday scene on its own account.

Between Huntly and Aberchirder two road services are given daily, this applying all the year round. Huntly is an important main line station about halfway between Aberdeen and Elgin, and through tickets are issued from each direction. Omnibuses leave Huntly (Town Square) at 9 a.m. and 4.50 p.m., and Huntly Station at 9.25 and 5.15 p.m., reaching Aberchirder at 10.35 a.m. and 6.25 p.m., respectively, after passing Kinnoir Road and through Lessendrum, Cobairdy, Bogniebrae, Auchingoul and Bridge of Marnoch. Services leave Aberchirder at 7.10 a.m. and 2.35 p.m. During the summer and early autumn, on Tuesdays, Thursdays and Saturdays, an extension service was operated from Aberchirder to Turriff via Boghead, Mountblairy Road and Forglen Church, returning from Turriff at 1.15 p.m. As thus operated the service connected up the main line and the Macduff branch, either of which could be reached from Aberchirder.

Between Alford Station the terminus of the branch line from Kintore and Strathdon (Bellabeg) motor omnibuses run daily at 11.20 a.m. via Bridge of Alford, Brux, Mossat, Kildrummy, Inverden, Lower Glenkindie, Upper Glenkindie, Bridge of Buchat and Heughhead, with an additional service on Saturdays at 5.30 p.m. Services leave Strathdon at 6.45 a.m. daily and at 3.20 p.m. on Saturdays. During the summer months there are two services each day, the first from Alford Station at 11.15 a.m. and the second at 5.30 p.m. The former extended from Strathdon to Corgarff (Allargue Hotel), from which place the afternoon return service starts at 2.20 p.m., the departures from Strathdon being at 6.45 a.m. and 3.20 p.m.



G.N.S. RAILWAY MOTOR-BUS FOR BRAEMAR LOADING LUGGAGE OUTSIDE BALLATER STATION. GOVERNMENT MOTOR VAN FOR BALMORAL CASTLE TO LEFT.

The Echt, Midmar, Cluny and Newburgh services possess special interest in that they are operated from Aberdeen itself, and, therefore, only indirectly in connection with the ordinary traffic of the railway. They start from Schoolhill Station, which is barely half a mile north of the Joint Station at several times during the day. The Rosemount Viaduct, which here spans the railway, is a scene of life and movement as the omnibuses are loading or unloading passengers and luggage.

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The villages served owe indeed, a great debt to the Great North of Scotland Railway, in that they have been provided with services which may be regarded as analagous to light railway facilities in directions which, while within a radius of a few miles of Aberdeen, are yet some distance from a railway route. The Echt, Midmar and Cluny services for some distance follow the same route and to some extent are associated beyond. On Tuesdays, Wednesdays and Thursdays an ominbus leaves Echt at 7.45 a.m. via Garlogie and Cairnie, reaching Schoolhill Station, Aberdeen, at 9 a.m. On Mondays, Fridays and Saturdays it starts from Midmar (Tillybirloch) at 7.20 a.m. At 11.30 a.m. it returns from Schoolhill Station to Echt. Meanwhile, at 7.30 a.m. an omnibus starts from Cluny for Aberdeen via Dunecht and Skene, also reaching Schoolhill Station at 9 a.m. The second service from Cluny leaves at 12.30 p.m., due at Schoolhill Station at 2 p.m., which is also the departure time for a return service to Cluny. On Mondays, Tuesdays, Wednesdays and Thursdays one omnibus leaves Schoolhill Station at 4.15 p.m. for Echt, while on Fridays and Saturdays the same service is extended to Midmar, due 6 p.m. At the same time an omnibus leaves Schoolhill Station for Dunecht and Cluny, due 5.50 p.m. On Mondays, Tuesdays, Wednesdays and Thursdays the 4.15 omnibus from Schoolhill to Echt returns at 5.35 p.m. from Echt via Dunecht to Aberdeen, due 7 p.m.; but on Fridays and Saturdays, when the outward service is extended to Midmar, it leaves that place at 6.10 p.m., and travelling via Echt (6.35 p.m.) and Dunecht is due at Schoolhill Station at 8 p.m. It will thus be seen that this service is somewhat involved so as to provide as wide facilities as possible without unduly adding to the number of vehicles required. In practice, particularly on market days, it is quite usual for any or all of these services to require one or more relief or additional vehicles. During the summer months omnibuses leave Midmar at 7.20 a.m.; Cluny, 7.30 a.m.; Echt, 12 20 p m. via Dunecht; Cluny, 12.15 and 3 p.m.; Midmar, 6.55 p.m. via Dunecht and Cluny at 7.10 p.m. for Aberdeen, the departure times from Schoolhill Station being 9.30 a.m., 2 and 5 p.m. for Cluny, 11 a.m. for Echt, and 5 p.m. for Midmar. A motor lorry is announced to leave Schoolhill Station regularly at 10.30 a.m. in connection with these services.

The Aberdeen-Newburgh service, although in an entirely different direction (as it follows the coast northwards from Aberdeen), is of a similar character, in that it gives transportation facilities through a fairly populous district. The winter arrangements provide for omnibuses from Newburgh at 7.45 a.m. and 2.45 p.m., and from Schoolhill Station at 10 a.m. and 4.30 p.m. During the summer months three services are operated from Newburgh, at 7.45 a.m., 3.10 and 7 p.m., and from Schoolhill Station at 10 a.m. and 1.30 and 5 p.m.

Between Fraserburgh and New Aberdour via Glenbuchty, Sandhaven, Pitullie and Rosehearty quite a frequent service of omnibuses is operated, even during the winter months, with departures from Fraserburgh Station at 9.30 a.m. and 3.30 p.m. through to New Aberdour, and at 10.30 a.m., 12.30, 3.30, 6.40 and 9.20 p.m., to Rosehearty. It will be noted that the 3.30 p.m. service requires two omnibuses, one terminating at Rosehearty and the other going through to New Aberdour. There is also a local service from Rosehearty at 7.10 a.m. to New Aberdour. In the opposite direction omnibuses leave New Aberdour at 7.55 and 11.10 a.m. and 5.5 p.m., and from Rosehearty at 9.50 a.m., 1.30, 2.45 and 8.30 p.m.

During the summer months a motor omnibus is operated between Ballindalloch and Tomintoul via Drumin Road, Downan, Achbreck, Tomnavoulin and Pole Inn. The outward service in connection with the 8.5 a.m. train from Aberdeen leaves Ballindalloch Station at 10.50 a.m., the afternoon omnibus leaving at 3.50 p.m. In the opposite direction omnibuses leave Tomintoul at 7.15 a.m. and 1.45 p.m.

A motor char-a-banc service is also operated between Ballater, Dinnet, Strathdon and Corgarff, linking up with the Alford-Strathdon service, and this, together with the Ballindalloch-Tomintoul service, is utilised for the famous "Three Rivers Tour." The Ballater-Corgarff service gives connections with trains at both Ballater and Dinnet Stations, also with the Ballater-Braemar motor omnibuses. Leaving Ballater at 9.35 a.m.,

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Corgarff is reached at 2.10 p.m., returning therefrom 10 min. later, and being due at Ballater at 5.35 p.m. The "Three Rivers Tour," or rather, series of tours, described as "linking up the magnificent country between the company's Deeside, Donside and Speyside sections," is arranged in three forms, as follows:—

Tour No. 22. Aberdeen to Dinnet by rail, by motor char-a-banc to Strathdon, and thence by the company's motor services to Alford through Glenbuchat, Glenkindie and Kildrummy, completing the tour from Alford to Aberdeen by rail. Fare for the round: first-class, 19*s.* 3*d.*; third-class, 15*s.* 6*d.*

Tour No. 23. Aberdeen to Dinnet by rail, by motor char-a-banc to Strathdon and Corgarff, by coach to Tomintoul, thence by motor to Ballindalloch, completing the tour by rail to Aberdeen. Fare for the round: first-class, 34*s.* 6*d.*; third-class, 28*s.* 6*d.*

Tour No. 24. Aberdeen to Alford by rail, and by the company's motor service through Kildrummy, Glenkindie and Glenbuchat to Strathdon and Corgarff, thence to Tomintoul, Ballindalloch and Aberdeen by the same route as Tour No. 23. Fare for the round: first-class, 32*s.* 6*d.*; third-class, 27*s.* 3*d.*

As thus arranged these tours are run daily from July 1 to October 3, inclusive, and tourists are allowed to visit Ballater and Grantown-on-Spey without extra charge. While arranged as through services these tours are not intended to be made continuously, and the journey can be broken or commenced and terminated at any point, the tickets being available for two months, while the routes can be reversed. Through fares are also issued from Glasgow and Edinburgh via Aberdeen, Nos. 23 and 24 being also available via Boat of Garten and Dunkeld in one direction.

The country traversed by these tours includes many of the most beautiful parts of Scotland. Thus from Aberdeen the tourist is taken "up the richly-storied valleys of the Dee and the Don, over the wild northern forest uplands of the Grampians and the Cairngorms by coach and motor car to Speyside, and thence by railway through the romantic Haughs of Cromdale, and by Aberlour, Keith, Huntly and Inverurie, with their hundred interests, beauties and memories, back to Aberdeen again." The route is via Dinnet, Ordie, Newkirk, Tillypronie and Boultenstone to Strathdon, and thence via Parkvilla, Forbes Lodge, Garchory and Corgarff School to Corgarff. Leaving Ballater at 9.35 a.m., the route is via Dinnet (10.15 a.m.) to Strathdon (arrive 11.40 a.m., depart 1.15 p.m.), thence arriving at

G.N.S. RAILWAY MOTOR OMNIBUS LOADING LUGGAGE AT BRAEMAR.

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Corgarff at 2.10 and leaving at 2.45 p.m. by coach, this portion of the route being hardly suitable for motor traffic, though magnificent scenery is traversed. Tomintoul is reached at 4.45 p.m. The tour is resumed next day, leaving Tomintoul by motor omnibus at 7.15 a.m. or 1.45 p.m. for Ballindalloch, whence the journey is completed by rail to Aberdeen. In the opposite direction the outward jonrney can be made from Aberdeen at 8.5 or 9.45 a.m. Tour No. 22, above-mentioned, includes only the Ballater and Strathdon-Alford motor sections, while Tour No. 24 comprises the Alford, Corgarff, Tomintoul and Ballindalloch sections.

It will, therefore, be seen that a wide variety of touring possibilities is thus opened up by the road motor services of the Great North of Scotland Railway, notwithstanding that, except in one or two special instances, as already noted, their main purpose is to provide all-the-year-round facilities for local passenger, goods and parcels transportation, in conjunction with the work of the railway proper. Fares are, in consideration of the distances concerned and the character of the traffic involved, very reasonable, and a number of special concessions are included. Thus, between Newburgh and Aberdeen, the return fare by the morning service on Wednesdays and by all services on Saturdays is 5*s*., as compared with the ordinary fare of 3*s*. each way. On Saturdays cheap tickets are valid for return, either the same day or on the Monday. Between Midmar or Cluny and Aberdeen the return fare on Wednesdays and Saturdays is 5*s*., and from Echt 4*s*. Through road and rail tickets are also issued in many instances, and generous arrangements for the transportation of free luggage and reasonable charges for the conveyance of paid luggage apply on all routes. In some cases the company specify that intermediate passengers can only be conveyed contingent upon there being room, but, as far as possible, when there is a heavy demand additional and relief omnibuses are run. Another condition is that during heavy weather omnibuses proceeding towards a railway station may start 15 min. earlier than the advertised times. It will be seen from the foregoing that the motor road arrangements of the Great North of Scotland Railway include many features of interest, and they are deservedly popular both with residents in the districts served and with tourists.

THE PICTURESQUE TERMINUS OF THE "DEESIDE" LINE, G.N.S.R.

Photo.] BALLATER STATION. [*J. F. Gairns.*

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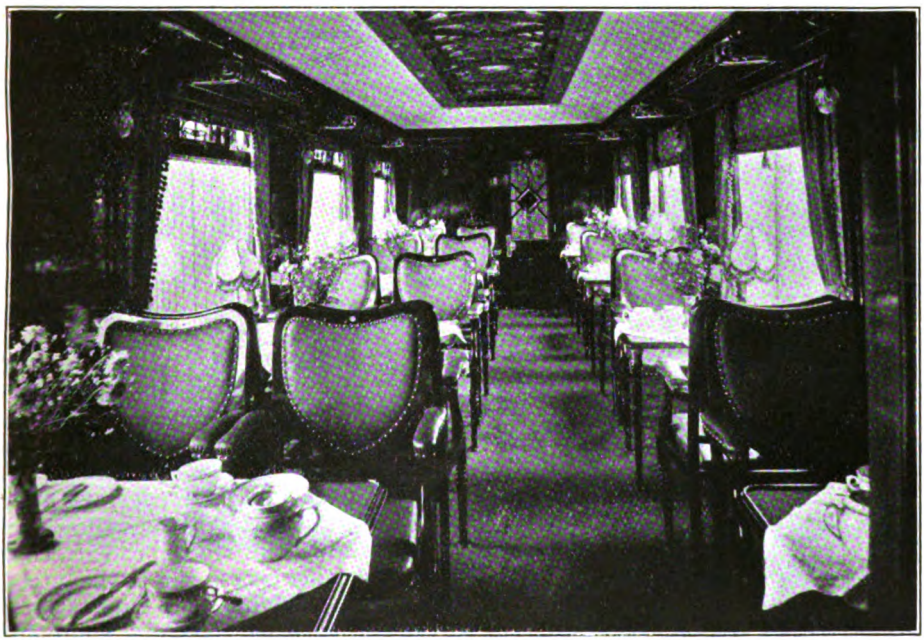
New Restaurant Car, Glasgow and South Western Railway.

WE are indebted to Mr. R. H. Whitelegg, Chief Mechanical Engineer, Glasgow and South Western Railway, for photographs showing exterior and interior views of a new composite class restaurant car, constructed to his designs at the company's works, Kilmarnock, now in service between Glasgow (St. Enoch) and Carlisle. The vehicle is interesting as embodying new features in decoration, seating and lighting arrangements.



INTERIOR OF FIRST-CLASS COMPARTMENT.

The car is carried on two four-wheeled bogies, each having a wheelbase of 10 ft. 6 in. and 15 ft. 9 in. over headstocks, the centres of the bogies being 47 ft. 9 in. The body of the car is 67 ft. over the mouldings and is divided thus : Vestibule 2 ft. 8½ in., first-class compartment 26 ft., pantry 7 ft. 6 in., kitchen 9 ft. 9 in. ; third-class compartment 17 ft., vestibule 2 ft. 8½ in. The first-class compartment accommodates 24 passengers and the third-class compartment 15 passengers.

The first-class compartment is finished in polished mahogany, inlaid, and the colour scheme is blue. The chairs, which are "tip up" and removable, are also polished mahogany and upholstered in blue morocco leather. The side-lights, which are plate glass with bevelled edges, are fitted with blue silk blinds and draped curtains of same material and the floor is covered with blue Wilton carpet to tone appropriately with the upholstery and the woodwork. All fittings are oxidised silver finish. The third-class compartment is finished in best Austrian oak, polished ; the colour scheme is green, and the chairs, also of best Austrian oak, polished, are upholstered in green morocco leather. As in the first-class compartment, the chairs are "tip up" and can be removed for cleaning. In this compartment

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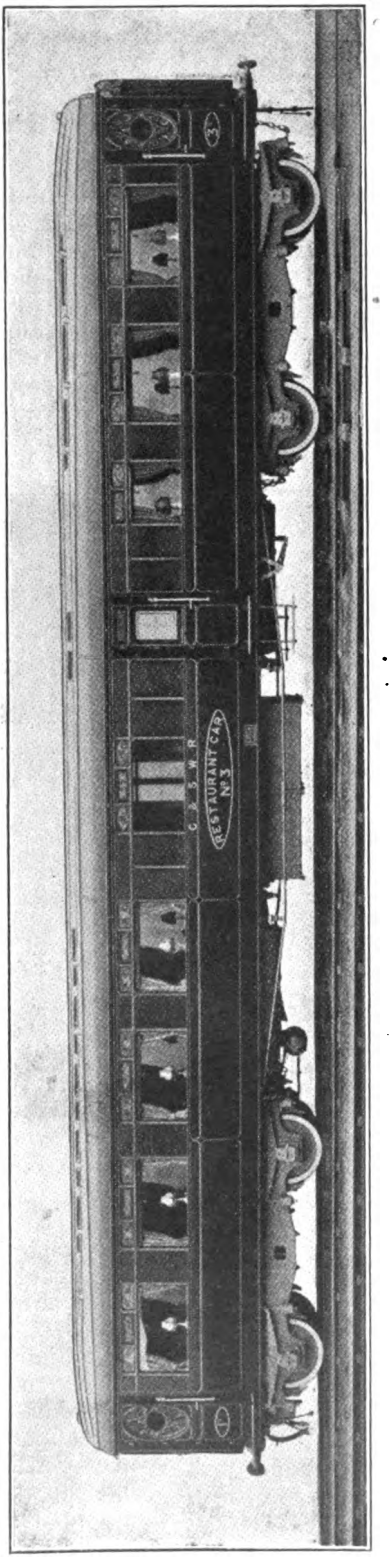

GENERAL VIEW OF NEW RESTAURANT CAR.

the blinds and draped curtains are green silk and the floor is covered with tile pattern linoleum, laid on felt, the green shade harmonising well with the upholstery and oak woodwork, the fittings being oxidised silver finish as in the first-class compartment.

Chairs and tables in both compartments are numbered so that seats may be allocated if required. The roof of each compartment is "domed," the sides and ends being painted "dead" white with a centre panel of leaded cathedral glass, the colours harmonising with the colour scheme of the compartment. These leaded glass panels are sub-divided into smaller panels of varying shapes by means of astrigals representing "old stone," the centre of the smaller panels being made circular.

Vestibules are finished in best Austrian oak, polished, and the floors are covered with best quality fibre mats recessed in well in floor with chequered aluminium surround. The vestibule door window is oval in shape with leaded cathedral glass in handsome metal frame and circular plate glass pane with bevelled edge in centre. Inside door handles and commode rails are oxidised silver finish. The kitchen has received special attention to make it as convenient as possible in what is a very limited space for the purpose, and has been fitted with a large gas cooker, with ovens, gas rings, grills and hot-water boiler. There is also a hot-plate rack over the cooker and a refrigerator or ice box in a corner remote from the cooker, nests of drawers for storing cereals, condiments and other necessaries to the kitchen, with ample shelving and cupboards for carrying the usual cooking equipment. The wall is lined with tile pattern "Alhambrine" painted white, and the floor is laid with "Induroleum," all corners being rounded and coved to assist cleaning.

The pantry is fitted with wash-up sink, having hot and cold water taps, drawers and cupboards for silver, plate racks, and wine bins, all available space being taken advantage of for carrying culinary equipment, and the walls and floor finished similar to the kitchen. A water tank, with a capacity of 100 gallons, is carried on the roof and the necessary gas receivers for supplying the cooker are carried underneath on the underframe. The water

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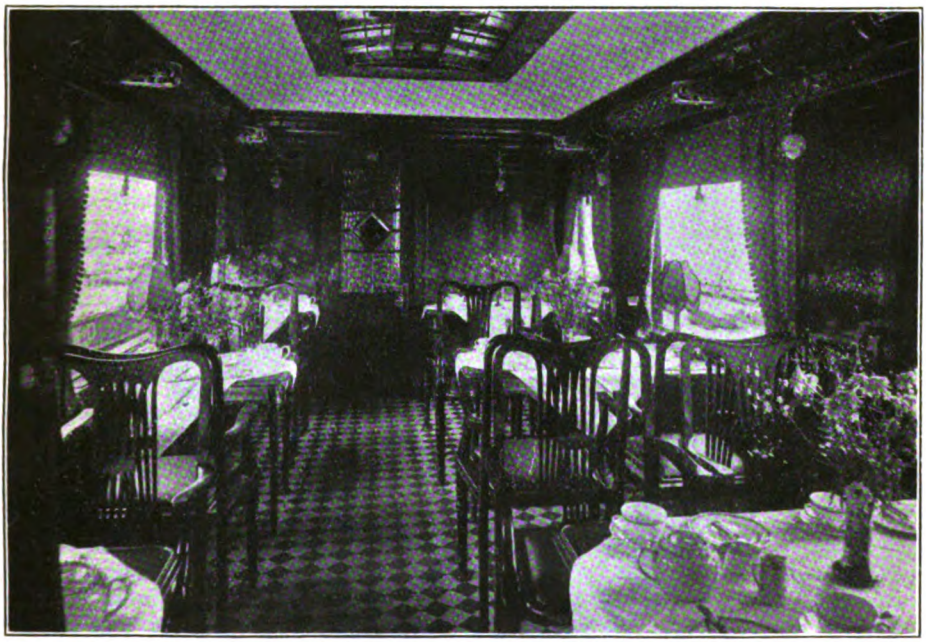
tank can either be filled from the roof or from the platform level. The car is electrically lit throughout, the compartments being lighted from the roof and having ornamental brackets or cornice mouldings and table lamps with silk shades. The roof lights and side-lights are covered with neat moulded glass tulip shades and the whole lighting effect is pleasing, and free from glare. The first-class compartment has five lights behind the leaded glass panel, two of which are reflected through alabaster bowls, the others being behind obscured bull's-eye glass, and the third-class compartment has three lights similarly situated and behind obscured bull's-eye glass.

Heating is by low-pressure steam through flow and return pipes, the piping being carried in a recess along the sides of the compartments just above floor level, and covered and protected by ornamental grids finished oxidised silver to harmonise with the other fittings. The heating for both compartments is controlled from the pantry by independent handles.

The carriage body top side-light panels over each of the large side-lights are leaded cathedral glass, and grouped in three parts, the centre parts being framed and hinged to form ventilators. Two ventilating ducts with openings to the interior through ornamental grids on either side of the roof of the compartments are in communication with the roof ventilators outside, and an extractor fan connected to similar grids at one end of each compartment, to extract the impure air, is placed in the pantry, ejecting the air through an outlet duct underneath the car. The kitchen and pantry are ventilated by means of hinged ventilators in the clerestory roof and over the quarter lights and doors. The pantry and kitchen are provided with roller shutter doors, which can be efficiently secured from the corridor. The corridor is finished in oak similar to the third-class compartment and is provided with a linen press and wardrobe for the use of the staff. The floor is of Induroleum, coved similar to kitchen and pantry, and a best quality fibre mat is recessed in flooring at the compartment doors. The car is fitted with the vacuum brake, and a passenger communication valve is provided in the pantry for cases of emergency.



INTERIOR OF THIRD-CLASS COMPARTMENT.

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THE RAILWAY PORTRAIT GALLERY.

Photo.] **MR. C. B. COLLETT, O.B.E., M.INST.C.E.,** [*Elliott & Fry.*

Chief Mechanical Engineer, Great Western Railway.

MR. C. B. COLLETT, Deputy Chief Mechanical Engineer, Great Western Railway, appointed to succeed Mr. G. J. Churchward, C.B.E., as Chief Mechanical Engineer from January 1, 1922, served his pupilage with Maudslay, Son & Field, of Westminster and Lambeth. He entered the Great Western Railway service as a draughtsman at Swindon in 1893, and subsequently filled the position of Chief Draughtsman before being appointed, in 1900, Technical Inspector of Swindon Locomotive Works. The following year Mr. Collett was appointed Assistant Works Manager, and in 1913 was promoted to be Locomotive Works Manager. Mr. Collett was appointed Deputy Chief Mechanical Engineer in May, 1919.

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Locomotive and Train Working in the latter part of the 19th Century.

THE GREAT NORTH OF SCOTLAND RAILWAY.

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

ONCE upon a time this was a shocking railway. A really very, very shocking railway. Why it was ever allowed to be called a railway at all passed comprehension. As a matter of fact, part of it between Aberdeen and Inverurie was not originally a railway, but a canal, and the company thoughtfully scooped in the canal, baled it out, and made their line on the remains. After which, some people in that district bethought themselves, when too late, that the canal would have been infinitely preferable.

Moreover, in the old days it was a very cantankerous railway. Exceedingly cantankerous. It had an aggressive way of rising to its feet to fight the other Company, more especially when it "had not a leg to stand on." On due consideration, this last sentence appears somewhat more Hibernian than Scotch, but let it pass.

The "Great North" was a Scottish reminder of our old friend the South Eastern Railway. But there were considerable differences, the first and foremost of which was that there was a strong vein of humour in the make-up of the latter, though it did not know it. The Great North had no humour. None whatever. Had it possessed any, my task in writing about it would have been much easier. Again, the South Eastern did run a few good trains. The Scotch Company did absolutely nothing of the sort. Its stopping trains could not even be dignified with the title "slow." They set the pace of a glacier, only the glacier would possibly have got there first. But one thing the Great North did thoroughly well—it charged "express" fares for the privilege of a passage on its glaciers; and these express fares were of an exceeding magnitude. Until after 1880 the third class fares of the "Great North" were practically 50 per cent. above the parliamentary fare of a penny per mile. True, there was one "government" (oh! prophetic name!) train in each direction, by which one penny per mile was charged. These naturally ran during the early hours, and were in existence because they had to be. Therefore this much must be put down to the credit of the Great North of Scotland. But the mystery remains as to how the Aberdonians of that day were ever got to pay such fares for conveyance in trains which averaged 12 to 15 miles per hour. Bang went the saxpences! Just think of it!

Perhaps it will be as well to say at once, before proceeding further with my narrative, that all this has changed, and changed from bad to excellent. I write this now in case some irate admirer of the "Great North" may think that my comments refer to the present-day railway. This is not the case—far from it. The Great North, in its rapid improvement, bears a striking resemblance to the Lancashire and Yorkshire Railway.

It seems possible that the cantankerousness and general behaviour of the original Company towards the travelling public, and more especially the Highlandmen, may have been due to the fact that the idea of the directors, when they first started operations, was to make their line from Aberdeen to Inverness, and that they never got to the latter place, but for a time only as far as Keith. The extension to Inverness, made under the title of the Inverness and Aberdeen Junction Railway, became part of the Highland Railway. The result was a very lively time in the railway world of North-East Scotland somewhat after the manner of the Bon Gaultier ballad:—

> "Phairson swore a feud against the clan McTavish
> Marched into the land, to murder and to ravish.
> For he did resolve to extirpate the vipers
> With four and twenty men, and five and thirty pipers."

One favourite method of carrying out their campaign was for the Great North

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people to time the departure of their trains from Aberdeen so close to the arrival of the trains from Perth and the south that passengers for Inverness had hardly any chance of catching them, unless they could sprint and had no luggage. For the stations at Aberdeen were nearly a mile apart, and the city had to be crossed, generally with impedimenta. The "Great North" officials waited until the hurrying passengers were in sight of their station, slammed the gates, and started their train. For some years after the line was allow them through facilities for the exchange of traffic at Elgin, and it would allow these only via Keith, a shorter mileage for the Great North, and a longer one for the Highland. This led to interminable wrangles, though it served the "Great North" right. They hardly deserved through facilities under the circumstances. It was, however, in the interests of the general public, as well as of the Great North shareholders, that they should have them, and they obtained them—eventually.

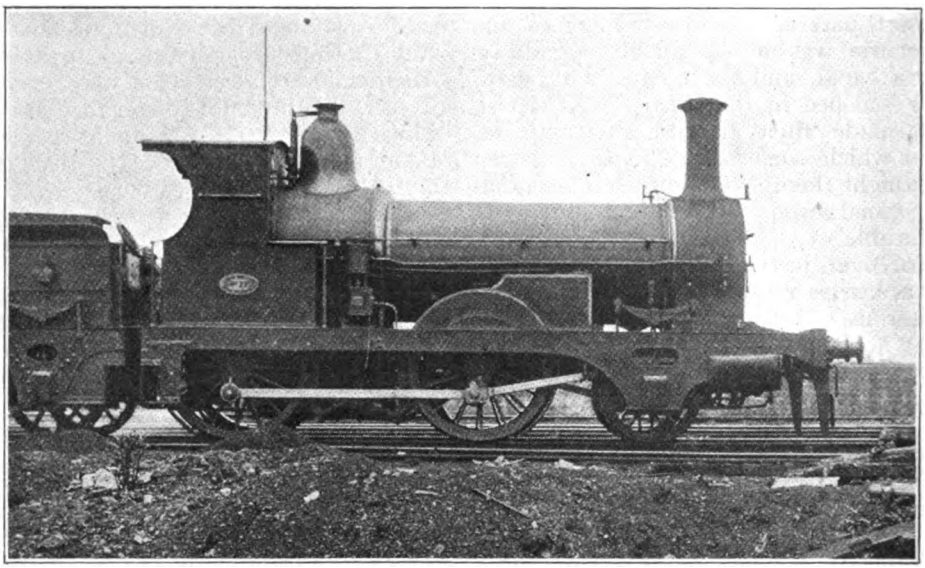

Photo.] [*Loco. Publishing Co., Ltd.*

2-4-0 MIXED TRAFFIC LOCOMOTIVE No. 27.

Designed by Mr. D. K. Clark and built by R. Stephenson & Co., in 1861.
Coupled wheels, 5 ft. diam. Cylinders, 16 in. by 20 in.

first opened it formed the only railway between Perth and Inverness. It was certainly a long way round, but apparently the Great North directors had an idea that they would continue to control the through traffic, and they might have done so for a few years longer had their treatment of the Inverness and Highland people not been so unpleasant. The Highland direct line to Perth would have been constructed sooner or later, as it was a geographical necessity, but the Great North people had a good deal to do with the starting of its construction so soon.

Then the Great North developed a grievance that the Highland Railway would not

Mr. (now Sir) W. M. Acworth, in "The Railways of Scotland" (1889) wrote: "The Great North, like the Great Eastern, has turned over a new leaf of recent years, and resolutely set itself to live down the reputation acquired by long and patient continuance in ill-doing. That the reputation was well deserved in the case of the Great North, there can be no question. Many are the stories told of its despotic treatment of passengers. . . . For one thing, its management steadily refused to effect a junction with the line to Perth and the South. Though invited to take a share in the construction of the present joint station, and to extend their line into

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it, they persisted in remaining at Waterloo station, which is now their goods depôt, a mile off down the quay. . . ."

The main line of the Great North extends from Aberdeen to Elgin. At Grange South signal box, about 48¼ miles out, the main line forks, and from this point there are two lines to Elgin. The inland line runs via Keith (53¼ miles) and Craigellachie Junction to Elgin, a distance of 80¾ miles. The coast line via Portsoy and Buckie makes the distance 87¼ miles to Elgin. Between these two lines of the Great North there is a third line belonging to the Highland Railway, which starts from Keith and by which the distance thence to Elgin is only 18 miles, as compared with 27½ miles by the Great North line via Craigellachie.

The remainder of the line consists principally of fairly long branches. The eastern branch leaves the main line at Dyce, 6¼ miles from Aberdeen, and terminates at Fraserburgh (47¼ miles), though what may be termed the main branch goes to Peterhead, a burgh which exports herrings and granite and imports convicts.

Further down the main line, at Inveramsay, another branch strikes away very nearly due north to Macduff, on the coast, a total distance of 50¼ miles from Aberdeen.

The best known branch is, however, the Deeside line to Ballater (43¼ miles), trains for which leave Aberdeen towards the south, and after running for ¾ mile over the Caledonian main line to Ferryhill Junction, branch off to the west. There is a very large suburban traffic over the first 7½ miles of this line to Culter.

Leaving aside the smaller Buchan, Banff, Cruden Bay and Alford branches, there is one other that may be mentioned, viz., the line which leaves Craigellachie Junction, in the north-west portion of Great North territory, and thence runs in a south-westerly direction for 33¼ miles to Boat of Garten, on the old Highland main line. For the last three miles of this distance, the Great North trains pass over the Highland metals. Except in the matter of distance carried, the traffic over this line is not very great, though it enables the Great North to compete with its Highland "friends."

The main line rises gradually from Aberdeen to Inveramsay (20¾ miles), though on the whole the gradients are not difficult. There is, however, a steep piece nearly 2 miles long, just after leaving Aberdeen, past Kittybrewster, most of which rises at 1 in 72. The heavy work begins at Inveramsay, whence there is a steady rise for more than 13 miles to Kennethmont, much of which is at 1 in 100, after which there is a long fall for 15 miles to the junction near Grange. This begins at 1 in 100, but mostly varies between 1 in 120 and 1 in 210. The coast line via Portsoy to Elgin is of a heavy, undulating nature, the gradients, though short, being severe, for several pieces are at 1 in 60 to 1 in 80.

On the inland main line the gradients are still heavier, but the faster trains, after the opening of the coast line, usually ran over the latter section. From Keith there is a rise 7½ miles long, much of which varies from 1 in 70 to 1 in 175. Then follows a steep descent for about 9 miles, a great part being 1 in 60 to 1 in 80. At Rothes begins another climb of 3 miles, 1½ miles of which are 1 in 50, followed by the final downhill run to Elgin, about 6 miles of 1 in 50 to 1 in 70, with one or two short pieces of 1 in 100. This is the heaviest part of the Great North main line.

A unique feature of Great North management is that there have never been any second-class carriages, and though the Midland Railway has frequently been credited with the abolition of these, it was certainly the Great North that led the way nearly 20 years before the Midland had thought of the change. But the Great North got more than its own back in another and more subtle way. It duly labelled the carriages "third," and charged fares which lay somewhere between "first" and "second" in amount. Naturally, no "seconds" were needed from the Company's point of view. What the public needed on that line was a "fourth" class, but there is no record that this ever materialised.

The old train service of the Great North was a marvel. I have no record of what it was like before 1880, when the terminus was at the old Waterloo station. The best down main line train in 1880, the 11.0 a.m., from the joint station at Aberdeen, reached Elgin, 80¼ miles, in 4 hr. 15 min., at the rate of 18¾ miles per hour. The 7.0 a.m. took three minutes longer, and the afternoon

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train at 4.45 p.m. managed to occupy the metals for exactly 4½ hours. All trains to Elgin travelled via the inland line and Craigellachie Junction, for the coast line was not then opened beyond Portsoy. They stopped at all stations, and were usually divided at Grange, whence a portion went to Portsoy and Banff.

The up trains from Elgin were, if anything, considerably worse. Two of the trains took 4 hr. 40 min. These were the best, and had a journey speed of 17·2 m.p.h. The third train apparently called in at a

and actually reached a journey speed of 20½ m.p.h., although the Peterhead line was not the main line. Of the up trains, one only took 2 hr. 10 min., the other three requiring 5 minutes longer.

On the Ballater line the Great North had to be more careful. There were a number of very influential people who lived near this line, including some at Balmoral. The up and down business trains morning and evening took 1 hr. 30 min. for the 43¼ miles to Aberdeen, with four stops. These were the only trains which attempted

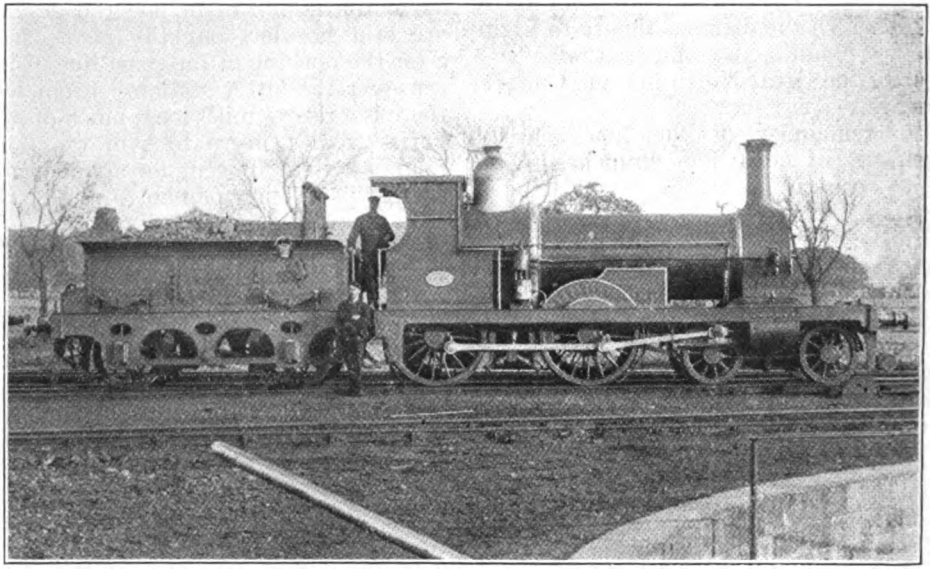

Photo.] [*Loco. Publishing Co., Ltd.*

4-4-0 MIXED TRAFFIC LOCOMOTIVE No. 29.

Built by R. Stephenson & Co., 1861. Coupled wheels, 5 ft. diam.
Cylinders, 16 in. by 22 in.

whisky distillery on the way, but nevertheless managed to cover the 80¼ miles to Aberdeen iu the phenomenal time of 6¼ hours, when punctual. I have not worked it out, but I should think that this must constitute a record for British railways. For this performance, it should not be forgotten, considerably more than one penny per mile had to be paid. I think the Company calculated the charges at so much per hour.

Between Aberdeen and Peterhead there were four trains in each direction. All the down trains took 2 hr. 10 min. for the 44½ miles, this was the high-water mark of Great North speeds north of Aberdeen,

to be "fast," and the best run was from Aberdeen to Crathes, 14¼ miles in 28 minutes. It was not a very great exhibition of speed, but the Great North managed to make it pass muster. They do it now in 19 to 20 minutes with much heavier trains.

It should, however, be stated that most of the railway was "single," and very great speeds were in no case to be expected; but that much better work could have been done the Company itself showed a few years later, after Mr. Moffat became general manager, and proceeded to put some life into the railway.

The tender locomotives have all been

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four wheels coupled, and no six-coupled tender engine has ever belonged to the Great North. The only engines with six-coupled wheels were nine tank engines which Mr. Manson put into service in 1884–5 for local traffic in the neighbourhood of Aberdeen.

The earliest engines, many of which were at work until the end of the nineteenth century, were 2-4-0 engines with outside cylinders, Nos. 1 to 7 and 15 to 18. These were designed by the late Mr. D. K. Clark, and built by W. Fairbairn & Sons, of Manchester, in 1854–56. These engines were almost similar to the illustration of No. 27, but the latter had smaller wheels, and the sandboxes in front of the driving splashers, as also the cab, are later additions by Mr. W. Cowan, who succeeded Mr. Clark. The passenger engines of the No. 1 class had 15-in. by 20-in. cylinders, 5 ft. 6 in. coupled wheels, and 3 ft. 6 in. leading wheels. The latter, it will be noticed, had outside bearings like Allan's "Crewe" engines, but the design differed in several respects from that of the latter. The total heating surface was only 808 sq. ft., and the total weight in working order 23¼ tons.

These and all subsequent engines on the Great North for many years were supplied with D. K. Clark's smoke-preventing system. A number of tubular openings were made through the sides of the firebox for the admission of air above the fuel, and jets of steam were projected through these openings, which served to induce and distribute the air within the firebox. The system is stated to have worked well, and certainly it would not have been used on the Great North for so many years had this not been the case.

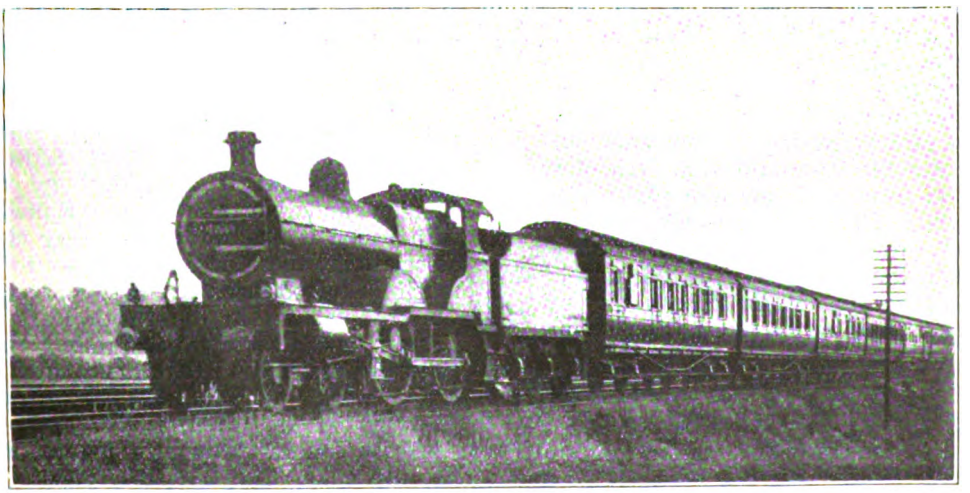
The earliest goods engines were almost similar to the foregoing, except that the four coupled wheels were only 5 ft. diameter. Nos. 8 to 12, by Messrs. Fairbairn, 1855, had 15-in. by 20-in. cylinders, but Nos. 19 to 27, by R. Stephenson & Co., 1860, had larger cylinders, 16 in. by 20 in. The illustration of No. 27 is typical of all the previously-mentioned engines.

The next engines, by Stephenson & Co., 1861, were of the 4-4-0 type, and from this time no four-coupled passenger or mixed traffic engines have ever been built for the Great North without a bogie.

The illustration of No. 29 shows these engines (Nos. 28 to 36). They were intended for goods and mixed trains, and had 5-ft. coupled wheels, and 16-in. by 22-in. cylinders.

(*To be continued.*)

ANGLO-SCOTTISH EXPRESS, MIDLAND RAILWAY.



DOWN EXPRESS NEAR NOTTINGHAM. 4-4-0 ENGINE No. 1041.

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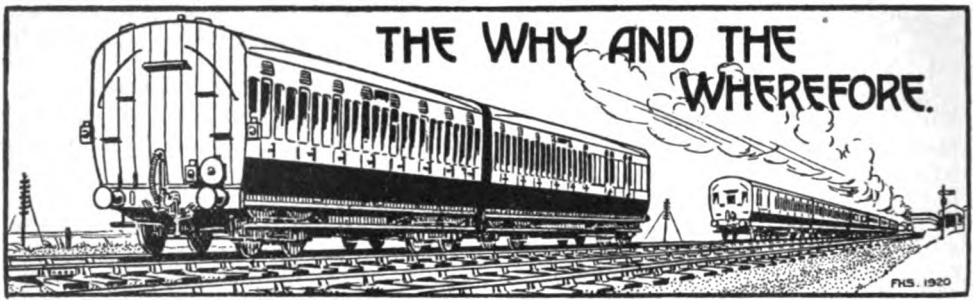

RAILWAY MAGAZINE *readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to locomotive sheds and to the dimensions of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. Queries respecting British Locomotive Practice and Performance should be sent to Mr. Cecil J. Allen, c/o* RAILWAY MAGAZINE, 30, *Fetter Lane, Fleet Street, London, E.C.4. Queries should not be of purely local interest. No reader should forward more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history and the like, readers should consult the pages of the "Railway Year Book." The twenty-fourth Annual Edition of this standard railway reference work is now on sale, 5s. net, or by post from the* RAILWAY MAGAZINE *Offices, 5s. 9d.*

Replies to Queries.

Not infrequently queries received are answered by articles, or paragraphs appearing in the next issue of the RAILWAY MAGAZINE. Readers whose enquiries are thus met, will, therefore, understand why a separate reply is not given.

Snow Hill Tunnel, Birmingham.

The original tunnel, which was for two broad gauge lines, reached only to Temple Row, and thence to Snow Hill, being an open cutting supported by retaining walls. The rise of 1 in 45 changed in the centre of this cutting to 1 in 132 to the end, and then level through the station. The open cutting was covered (about 1874) by three brick arches on brick piers, and over these arches the Arcade was erected. Some premises in Carr's Lane were erected on girders resting on the arch, and for others the foundations on arch of tunnel were formed of cast-iron plates made to radius of back of arch, which were seats for wrought-iron girders carried on to brick walls built clear of the tunnel. Information in regard to the factory said to rest on girders across the tunnel is lacking.

[Reply to G. W. BISHOP.]

Distances and Times.

Your example of a journey at a higher average speed by using two stopping trains and one express, than by a through express is of interest, but is hardly important, seeing that the through express takes a complicated route and has to fit in with trains on several more or less distinct sections. Thus it could not be given a later start without interfering with the slow train behind (which would, incidentally, throw your alternative series of connections out of gear), and at a later stage must fit in with other trains. This question of fitting in accounts for many anomalies in railway time-tables, and is the "rock" upon which amateur compilers of train services and proposers of accelerated and altered timings so often come to grief.

[Reply to F. MARSHALL.]

Great Northern and North London Amalgamation.

Seeing that the Railways Act of 1921 places the North London in the North-Western, Midland and West Scottish group, and that it is worked by the London and North Western Railway, with which it has always had very close associations, there does not appear to be much likelihood of an alternative proposition to place it in the North Eastern, Eastern and East Scottish group. It is generally understood that North London trains work over the Great Northern Railway as an alternative to Great Northern Railway trains working over the North London Railway, as a matter of convenience and arrangement.

[Reply to K. A. KINDON.]

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Furness Railway Gradients.

Between Braystones and Whitehaven the steepest gradient going north is 1 in 347, after leaving St. Bees, and 1 in 295 going south from Corkickle. From Braystones the line rises at 1 in 419 and 460, is then level, leading to a fall to Nethertown at 1 in 870. A rise at 1 in 754 is followed by a continued descent at 1 in 966, 532, 514, 364-7 and 361 to St. Bees. A short level stretch is succeeded by a descent at 1 in 916, rise at 1 in 347, level and a fall at 1 in 333, 295 and 377 at Corkickle, completed by six chains level and a rise at 1 in 382 to Bransty.

[Reply to R. H. FLEMMING.]

Midland Railway (London, Tilbury & Southend Section.)

The expresses between Fenchurch Street and Southend, usually 11-13 bogie coaches, are mostly worked by the enlarged and rebuilt 4-4-2 tank engines, but the intermediate series, also with 6-ft. 6-in. coupled wheels, take a share. It is rare, however, for the older 6-ft. class to work Southend expresses, though they take trains *via* Tilbury. Locomotives of any class may be found on the Ealing-Southend trains, though the intermediate 4-4-2's are the more usual.

[Reply to "TILBURY LOCO."]

Maximum Speeds on the Great Eastern Railway.

On a journey to Yarmouth one may expect to attain the highest speeds at Ingatestone, Witham, approaching Colchester, and at Manningtree; in the up direction at Manningtree, Kelvedon and in the descent of Brentwood bank, the last-mentioned especially furnishing high speeds on most journeys. Although sharply graded the section between Ipswich and Yarmouth is not adapted for very fast running.

[Reply to C. S. ORPEN.]

Lettering on Signals at Liverpool Street.

Letters "S," "L" and "T" refer, respectively, to the Suburban, Local and Through lines from Liverpool Street to Bethnal Green, and for the platform signals at the terminus, are combined in each case with the number of the platform line to which they refer. The storage roads between platforms 9 and 10 are known as "9A" and "10A," respectively, which explains the lettering on certain signal arms of "9 A.L., 9 A.T.," &c.

[Reply to H. A. SOPER.]

Great Central Railway London-Bradford Expresses.

These trains have been worked regularly for a considerable time past by the large four-cylinder 4-6-0 engines of the Lancashire and Yorkshire Railway between Sheffield and Bradford, and rebuilt and superheated engines of this type are now on the service. One engine in steam is sufficient to work all four trips daily. The intermediate gradients are very severe.

[Reply to F. W. LUPTON.]

"Triangular" Stations.

Mr. H. L. Hopwood mentions additional examples, Queensbury, Great Northern Railway, at the junction of Bradford-Halifax and Keighley routes, which has six platforms, two for each section, and Bishop Auckland, North Eastern Railway, which has a triangular platform giving three platform faces, one for each route, and a further platform on one section. "Yorkshireman" also specifies Queensbury, describing its location more fully.

[Further reply to A. RANSON-COWLISHAW.]

"Foreign" Engine Working at Southend.

No doubt the London and North Western Railway 4-6-0 locomotive of the "Prince of Wales" class, noted at Westcliff (Midland Railway), had worked a special train for some reason. We can give no further particulars. For the Great Northern Railway excursions to Southend via the Great Eastern Railway route Great Northern Railway 0-6-0 goods engines were generally employed.

[Reply to S. DIESCH.]

Highest Altitudes.

Collahuasi on the Antofagasta and Bolivia Railway, 15,809 ft. above sea level, is the highest point reached by a railway. Galera tunnel, on the Peruvian Central Railway, is 15,583 ft. above sea level. See page 52, RAILWAY YEAR BOOK, 1921, where a table of the highest railway altitudes is given, corresponding data in regard to British lines appearing on page 397.

[Reply to T. W. LINSELL.]

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North Eastern Railway Three-Cylinder 4-6-0 Locomotives.

Although classed as express goods engines, there is no reason why these, in common with other 4-6-0's, should not take turns on main line working, especially with semi-fast trains, though it is certainly unusual for them to take important East Coast expresses. You do not, however, specify the particular train on which you saw No. 943.

[Reply to A. J. T.]

Gloucester Station.

This was for a long period terminal, and through trains had to come in and then back out, or *vice versa*. The old lines centreing upon Gloucester were described in the February and March, 1904, issues of the RAILWAY MAGAZINE, and in Mr. Ahrons' articles many interesting references to working on this section of the Midland Railway were included.

[Reply to G. L. REES.]

Heaviest Locomotive.

While the reply given recently was correct on the basis of information available at the time of writing, as will be seen from particulars in our last issue, No. 4700, Great Western Railway, now has the larger boiler originally designed for it, and its weight, without tender, is therefore, 82 tons as suggested.

[Further reply to A. W. MAINWOOD and A. COCKELL.]

British and Continental Railway Gauges.

As the Continental gauge is based upon the metric system, 1,430 m., it is about half an inch wider than the British 4 ft. 8½ in. gauge. Hence our rolling-stock was able, during the war, to run on Continental lines, but the gauge would be too tight to permit of the reverse being done.

[Reply to Rev. H. C. COURTNEY.]

Longest Station Platforms.

For particulars of largest stations and lengths of longest platforms, see RAILWAY YEAR BOOK, 1921, page 44. The greatest lengths are: York, up main, 1,692 ft.; Edinburgh (Waverley), 1,680 ft.; Aberdeen (Joint), 1,596 ft.; and Crewe, 1,509 ft. Pontypridd (Taff Vale Railway) is an important station, but its platform lengths do not equal these figures.

[Reply to "SHUNTER."]

Great Eastern Railway 0-6-2 Locomotives.

No. 1003 has the top-feed connections made through the steam dome, which otherwise serves its usual purpose. Your correction that North British Railway 4-4-2 tank engine No. 135 has not been rebuilt is noted, and your kind remarks in regard to the RAILWAY MAGAZINE are appreciated.

[Reply to J. T. RUTHERFORD.]

Locomotive Wheel Types.

The "Whyte" or numerical system was introduced about 20 years ago by the American Locomotive Company. The German system (2-B-1, &c.) appeared about the same time, but we do not know its origin. The numerical system is also used on the Continent denoting axles instead of wheels, thus: 2-3-1 = 4-6-2.

[Reply to D. B. M.]

"Crimea" Coal Yard, Great Western Railway.

The coal yard on the down side of the main line at Westbourne Park, between Great Western Road and Westbourne Park Villas, has been for many years known as the "Crimea" Yard, and it is surmised that probably the yard was opened somewhere about 1854.

[Reply to "PEACOCK."]

Slip Coaches on the Great Northern Railway.

For many years, until the war, the up day "Scotsman" (10 a.m. from Edinburgh) slipped a coach at Doncaster. In years gone by the Great Northern Railway indulged extensively in the practice of slipping, but later the custom fell into disuse.

[Reply to R. E. ABBATT.]

Longest Through Journeys.

Before the war this was from the Russian frontier to Vladivostock, by the Trans-Siberian Railway, some 5,000 miles. The longest now operated are those across the United States and Canada. Average speeds for such journeys are necessarily low, including stops, usually about 25 m.p.h.

[Reply to T. W. LINSELL.]

Colne Valley & Halstead Railway.

This line leaves the Marks Tey-Shelford-Bury St. Edmunds branch of the Great Eastern Railway at Chappel, and rejoins the Shelford and Cambridge section at

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Haverhill. It is 19 miles in length and possesses the following tank engines: 1 (0-4-2), 3 (2-4-2) and 1 (0-6-2).

[Reply to T. CAMPBELL.]

Steam Heating on Great Eastern Railway.

Only some of the suburban trains and engines are yet fitted with steam heating apparatus, so that a fitted train must have a fitted engine if the heating system is to be available. We have noted instances of the steam heating not being available; also of its being unmistakably in use.

[Reply to J. A. SMITH.]

Locomotive Wheel Arrangements.

In most foreign countries the up-to-date passenger locomotives are of the 4-6-2 type, ordinary goods engines being 2-8-0. There are, however, many modern 4-6-0's, while the 2-8-2 is a fairly common goods type in the United States of America, and to some extent, elsewhere.

[Reply to F. E. WHITING.]

Signal Alterations, London, Brighton and South Coast Railway.

Mr. F. N. Lance points out that another factor governing the placing of signals with a view to good "sighting" is the network of overhead wires and their supporting structures, and under some circumstances a short post is therefore preferable.

[Further reply to "CHEMIN-DE-FER."]

4-6-4 Tank Engines, London, Brighton and South Coast Railway.

No. 328 is fitted with top-feed apparatus, and No. 327 is not. We are informed that No. 329, the first of the new series is now running her trials; we have no information as to whether these engines will bear names.

[Reply to R. G. BOLTON and "BALTONIAN."]

Small Railways.

References to or articles on the railways mentioned have appeared in the RAILWAY MAGAZINE, recent years only, as follows: Eskdale, June, 1916 and September, 1920; Campbeltown and Macrihanish, February, 1921; Southwold, May, 1914; Lynton and Barnstaple, May, 1917.

[Reply to W. K. NASH.]

Birmingham to Bristol, Midland Railway.

There is an express from Birmingham at 1.35 p.m., calling at Cheltenham and Gloucester only, which doubtless corresponds to the train you mention. It is the fastest train of the day, and runs through from Bristol over the Great Western Railway to Torquay and Paignton.

[Reply to EDGAR KNIGHT.]

Relaying Indications, Great Western Railway.

Boards to which you refer indicate the junction of two lengths of track re-laid at different dates. The information shown on them is the date of relaying each section and the year in which were rolled the rails employed.

[Reply to E. A. BEET.]

Avonmouth Line, Great Western Railway.

We know of no proposal at any time to complete the triangle at Stoke Gifford by making a direct spur from Patchway to the Avonmouth direction, neither can we see of what use such a line would prove.

[Reply to "SILURIAN."]

Link Motion.

The curvature of the expansion link is usually struck from the centre of the axle so that it moves radially thereto, except as modified by the eccentrics according to their positions and the adjustment for reversing or varying cut-off.

[Reply to E. V. ARDRON.]

Midland Railway Locomotives.

Your query, which could only be answered by giving long lists of numbers, is barred by the rules of this section. RAILWAY MAGAZINE, March, 1920, gave details of the present and the old numbering.

[Reply to "ASHPAN."]

"Quintiple" Restaurant Car Trains, Great Northern Railway.

Your query is answered by article published last month. No further information beyond that given is available. Your remarks concerning the new "1660" class of 2-6-0's are noted.

[Reply to W. RAYNER THROWER.]

Midland Railway Locomotives.

Load classifications and lists of particular engines cannot be given. Please see rules. Your note as to having seen 4-2-2 engine, No. 690, recently on an up semi-

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fast train at Kentish Town is hereby passed on.

[Reply to "CHALONER-WHIN."]

Tractive Force of Locomotives.

Owing to the dropping of a small "2," an error appeared in the formula for ascertaining tractive force given in the December issue, p. 422. The formula should read:—

$$\text{Tractive Force} = \frac{d^2 \times s \times p}{D}$$

where "d" = diameter of cylinders, "s" = stroke, "p" = mean effective steam pressure (assumed at 85 per cent. working pressure), and "D" = diameter of driving wheels. For 3-cylinder simple engine multiply the result by 1·5, and for 4-cylinder multiply by 2.

[Further reply to F. P. MILLARD, P. H. LEE and others.]

Railway Grouping.

It is premature to prophesy as to methods when grouping is completed, but presumably the engines and rolling-stock of each group will eventually be brought into line in regard to colours, lining out and other details.

[Reply to A. W. YOUNG.]

North British Railway Locomotives.

Two "Atlantics" have just been completed for this railway, but we know of no more on order, nor of 4-4-0 engines of the superheated "Scott" type. "Atlantic" No. 869 was named *Dundonian* at the time of building.

[Reply to "AULD REEKIE."]

Running Plate, "736" Class, London and South Western Railway.

This is raised sufficiently to clear the coupled wheels, cylinders and motion, in order that the various working parts may be readily accessible, after Continental and American practice.

[Reply to F. P. MILLARD.]

Largest Signal Boxes, Great Eastern Railway.

Liverpool Street West Box has 244 levers, of which 17 are spare; East Box, 136 levers, 6 spare; Stratford Western, 140 levers, 8 spare; and Stratford Central Junction, 165 levers, 15 spare.

[Reply to H. A. SOPER.]

Metropolitan Railway Electrification.

No doubt when electrification is extended beyond Harrow on the Aylesbury route, the frontier station for changing electric and steam locomotives will be altered accordingly.

[Reply to R. NEWMAN.]

Automatic Signals, Midland Railway.

No information as to automatic signals between Skipton and Hellifield, Midland Railway. If automatic, obviously they must be controlled by track circuit or equivalent means.

[Reply to "ASHPAN."]

"Ragtime" Locomotives, Great Northern Railway.

We believe this slang description is applied to the "1000" class, but it is neither dignified nor appropriate, and is certainly not worthy of perpetuation.

[Reply to F. W. LUPTON.]

Badminton, Great Western Railway.

We do not suppose that important South Wales expresses would be stopped here conditionally unless there were adequate reasons for doing so from the financial standpoint.

[Reply to "SILURIAN."]

Carlisle-Stranraer.

To Stranraer Harbour the distance from Carlisle is 106 miles, and the times observed by the Belfast boat trains are 2 hours 53 min. down and 1 min. less up. This is not a through mail route.

[Reply to ALEX. W. ANDERSON.]

Webb Compound Locomotives, London and North Western Railway.

These engines have many times been illustrated in the RAILWAY MAGAZINE, and your request for a view of one in its unconverted condition is noted.

[Reply to H. S. SLACK.]

Scissors Crossings.

Two cross-over roads running in opposite directions. These are sometimes called double-crossings. A good example may be seen at Cambridge Great Eastern passenger station.

[Reply to A. B. F.]

2-8-0 and 0-6-4 Tank Engines.

There is no such wheel arrangement for tank engines on the London and North Western, London, Brighton and South Coast or Caledonian Railways.

[Reply to SIDNEY POWELL.]

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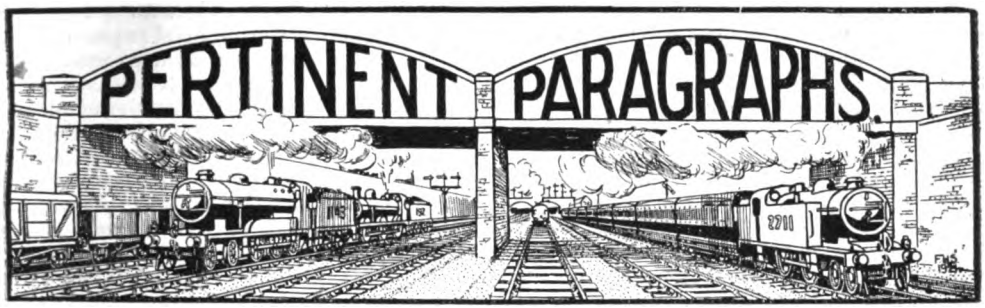

New Superheater "Atlantic" Locomotives, North British Railway.

Two new "4-4-2" locomotives, generally of the well-known class but fitted new with superheating apparatus, have recently been added to the locomotive stock of the North British Railway, and we are indebted to Mr. W. Chalmers, Chief Mechanical Engineer, for the photograph of one of them reproduced as frontispiece. They are numbered and named respectively: 509, *Duke of Rothesay*, and 510, *The Lord Provost*. Leading particulars are as follows:—

Height from rail to centre of boiler	8 ft. 11 in.
Diameter of boiler	5 ft. 6 in.
Length of boiler barrel	15 ft.
Length between tube plates	15 ft. 4¾ in.
Width over footplate	8 ft. 10½ in.
Distance between centres of cylinders	6 ft. 8½ in.
Cylinders	21 in. by 28 in
Coupled wheels	6 ft. 9 in. diam.
Bogie wheels	3 ft. 6 in. diam.
Trailing wheels	4 ft. 3 in. diam.
Heating surface—	
Large tubes	483 sq. ft.
Small tubes	1,136 sq ft.
Superheater	385 sq. ft.
Firebox	184·8 sq. ft.
Total	2,188·8 sq. ft.
Grate area	28·5 sq. ft.
Steam pressure	180 lb. per sq. in.
Adhesion weight	40 tons.
Weight of engine in working order	76 tons 14 cwt.
Weight of tender in working order	45 tons 8 cwt.
Weight of engine and tender	122 tons 2 cwt.

Among the special fittings the Wakefield mechanical lubricator may be noted, and this is clearly visible at the base of the smokebox, together with its operating connections from the valve gear.

Railway Travel in Scotland.

MAJOR A. R. MUNRO sends some interesting comments which may be quoted as follows:—On the occasion of a journey from Edinburgh to Inverness and back, I had the luck to travel behind some of the very latest engines on the North British, Highland and Great North of Scotland Railways, and I think the following notes may be of general interest. I left Edinburgh by the North British "Highland" express at 10.15 a.m. on a recent Tuesday morning, the train consisting of seven 8-wheeled bogie coaches and a 6-wheeled van, totalling 204 tons unloaded, with a fair average complement of passengers and luggage. The engine was No. 510, *The Lord Provost*, one of the new "Atlantics" referred to in your September issue; but these are not identical with the old "Atlantics," as they are built with superheaters fitted, which the driver assured me was a very great improvement. This train is allowed 83 minutes for the 48 miles, including stops at Haymarket, Dunfermline (3 minutes for ticket-checking) and Bridge of Earn Junction cabin for service purposes, and we reached the ticket-platform at Perth well up to time; but were held up there for five minutes before the arrival platform was clear, thus reaching the General station three minutes late. This is the first time I have travelled behind an "Atlantic" on this line, which was formerly worked by the "Scott" class, so I cannot compare this run with any previous one of the same type. The day was fine, but with a strong head-wind blowing against the train. Continuing my journey by the Highland Railway, we left Perth punctually at 12 noon with six bogie coaches, the engine being No. 55, *Clan Mackinnon*, one of the new 4-6-0 type of express passenger engines. We were three minutes late in leaving Blair Atholl, but made this up in crossing the Grampians and reached and left Kingussie on time. We arrived at Aviemore punctually, and were ready to leave five minutes early, but unfortunately a goods train preceding us had not reached the next tablet station, and we were not allowed to leave till five minutes late. Following on this delay we were held up for 15 minutes at Tomatin to avoid delaying the 3.30 p.m. up express from Inverness, which we might have done if allowed to proceed to the ordinary crossing station; and it said a lot for our engine and

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its driver that we reached Inverness only five minutes after our booked time of arrival. Two days later I started on my return journey by the 7.40 a.m. train from Inverness to Keith, *via* the Mulben route. As this is a train stopping at every station, I need say little of the run, except that we reached Keith punctually to time. The engine from Inverness to Forres was No. 71, *Loch Garve*, one of the ordinary 4-4-0 class, while from Forres to Keith we were "horsed" by No. 31, a 0-6-4 side tank engine built in 1911, and intended primarily for "banking" purposes on the Perth section, but less required now that the train engines are more powerful. This engine made light of the Mulben bank, which used to tax the old 4-4-0's on this section. At Keith we had to wait while the Great North trains from Elgin came round by the Craigellachie route, and left Keith with the latter at 10.47, the scheduled time. At Cairnie Junction the coast train joined us, and its engine ran the combined train unassisted to Aberdeen. The run from Huntly to Aberdeen was exceptionally good, the distance from Huntly Station to Schoolhill ticket-station, about 40 miles, being done in little over 45 minutes, and the Joint station reached at 12.13, three minutes before schedule time. The engine, as I only discovered on arrival (this run allowed no time for voyages of exploration *en route*) was No. 48, *Andrew Bain*, a 4-4-0 built in 1920. It has a comparatively small boiler and a 6-wheeled tender; but to average such a speed over a line including the Kennethmont bank was an achievement of which any designer and driver might be proud. I may mention that the coast train included a new corridor bogie coach belonging to the Great North of Scotland Railway and labelled "Elgin and Edinburgh (Waverley) *via* Aberdeen and Tay and Forth Bridges," which was attached to the 12.50 p.m. North British express and would reach Edinburgh at 4.41. I remained in Aberdeen on business, and then travelled south by the 3.40 p.m. train, which is due to reach Edinburgh at 7.33 p.m. The engines were from Aberdeen to Dundee No. 869, *Bonnie Dundee*, and from Dundee to Edinburgh, No. 876, *Waverley*, both being original "Atlantics" as rebuilt at Cowlairs; and time was kept punctually, but nothing occurred of special interest.

Railway Bills in Parliament.

THE general trend of the few railway Bills and Scottish Provisional Orders that are being promoted for the coming Session of Parliament is towards the consolidation and strengthening of the companies' existing positions, to applications for permission to operate road motor services on a less restricted basis, to meet financial requirements, and in some instances in view of conditions arising out of grouping. No new railway works of any magnitude are contemplated by existing companies, though the Port of London and the Midland Railway jointly propose the construction of certain river works at Tilbury. Independent promoters, however, again revive the Thames Deep Water Wharf and Railways scheme, which has been so often before Parliament in various forms.

Though not contemplating fresh powers for extensions the railway companies are keeping alive the construction powers which they already possess. As instances, the omnibus Bills promoted by the Caledonian and the Great Northern Railways may be noticed, and also the borrowing powers being sought by the Brighton Railway for "equipment of their railways for electrical traction." Additional money powers are also being asked for by the Caledonian and the Midland Railway companies. The Metropolitan Railway notice makes reference to provisions for the appointment and duties of a managing director or managing directors. The companies comprising the North-Western and Midland and West Scottish Group have notices—one for England and one for Scotland—of application for general powers to own and work road vehicles, and to erect the buildings necessary for such operations.

Provisions relating to costs of arbitration in certain events will be included in the Caledonian Order, and in the Great Northern and the Midland Bills. The Great Northern Bill will authorise the company to enter into agreements with rating authorities as to the assessment of its property, and will also "provide for limiting the amount of compensation and claims in respect thereof in cases of recent improvements, alterations or buildings, and recently created interests in lands or property." The City of Dublin Steam Packet Company appears, in view of its associations with Irish railways and its interest in the City of Dublin Junction Railways, as necessitated by the winding-up and dissolution of the company. The Highland Railway Company has applied for a Provisional Order for extension of time in regard to powers already granted, and to confirm the purchase of land at various stations.

North British Railway Dividends.

THE directors of the North British Railway have issued a statement to the shareholders in view of the recent decision of the Court of Session on the appeal of the Ministry of Transport against the judgment of the Railway and Canal Commissioners. At the hearing of the appeal the Minister contended that,

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under the contract between the railway companies and the Government, his discretion in dealing with the amount of monthly payments of compensation was absolute, and was not subject to review on the merits by the Railway and Canal Commissioners as arbiters. This contention of the Minister proved successful, with the result that the Commissioners' order for payment of the £430,000 in dispute was recalled. As indicated last month, this decision in no way affects the company's right to recover the £430,000 as part of their expenditure on the maintenance of their rolling-stock in the ultimate settlement of the compensation due to the company. No time will be lost in submitting the company's final claim to the Government, and, if need be, to the arbitration of the Railway and Canal Commission, and they are hopeful that the matter will be concluded at an early date. This seems to indicate the chance of some agreement being arrived at, which is all the more desirable in view of the fact that it will not be possible to make any declaration of interim dividends for the current year as, in addition to the £430,000 withheld from the claim for December, 1920, the Ministry have deducted further sums amounting to £690,000 from the company's subsequent monthly claims during the period from January 1 to August 15.

Railway Returns for 1920.

A PRELIMINARY statement was issued in April last, and in connection with the complete returns now published, it is pointed out that the provisional figures closely agree with the final figures now available. The year 1920 is the first complete year covered by the powers contained in Section 18 of the Ministry of Transport Act, 1919. By virtue of these powers "a series of new and important four-weekly statistics was instituted." These statistics show that the average wagon-load for standard gauge railways in the United Kingdom was 5·34 tons, and the average train-load 130·25 tons. The train-miles per train-hour were 13·05 (coaching) and 7·83 (freight), and the net ton-miles per engine-hour 419·98. The average length of haul was 57·73 miles for all classes of freight, general merchandise being 89·75 miles; coal, coke and patent fuel, 47·41 miles; and other minerals, 50·72 miles. The compilation of such figures as net ton-miles, wagon-miles and engine-hours is, as the report says, "a new departure in official railway statistics," and attention is drawn to the improved information—a useful addition—relating to the principal commodities conveyed by British freight trains. The usual comprehensive series of tables, together with additional tables arising out of the new statistics, are included in the returns which comprise 280 pages.

From Edinburgh to Dundee by the Coast Line.

ON this route the "Atlantics" have tasks differing essentially from those of the "Waverley" route, but the journey possesses many features of interest which justify detailed description. On the 10.25 a.m. train from Waverley, No. 871, *Thane of Fife*, had a load of 11 bogies, including an East Coast dining car taken over by the North British Railway for its own traffic, and an empty sleeping car, so that the load was certainly 350 tons. Weather was fine and there was no wind to speak of. To Dalmeny, junctions, &c., influence the running considerably, so that the 9½ miles took 15 min. 20 sec. Crossing the Forth Bridge steadily, in the neighbourhood of North Queensferry and Inverkeithing speed orders are numerous, and intervening tunnels rapidly change the view; at one moment over the Firth of Forth, then overlooking the harbour. At Burntisland the line passes on embankment close to the sea, or on a ledge cut from the hillside, giving splendid views of a wonderful stretch of sands, and of the harbour works at Kirkcaldy, with the factories of that busy town. All along the coast is, indeed, a combination of scenic interest, splendid sands and rocky views, attractive holiday resorts, and industrial activity. From the train-running point of view, however, this section has too many junctions and curves for high speed, while it has gradients as steep as 1 in 94, but Kirkcaldy was passed in 39¼ minutes (26 miles) from Edinburgh. Sinclairtown is almost part of Kirkcaldy; at Dysart, the town of that name by the sea is overlooked from the train.

Diverging inland, though frequently scenically interesting, there is nothing calling for special remark, though occasional steep gradients and numerous junctions still preclude fast running. A stop was made at Cupar (44½ miles) in 67 minutes from Waverley. On the run thence to Dundee a glimpse of the Firth of Tay is had near Dairsie, and from St. Fort the famous bridge, with the remains of the ill-fated structure which preceded it, provide most interest. A stop was made at the Tay Bridge station in 20 min. 50 sec. from Cupar (14¾ miles).

From Dundee to Aberdeen.

CHANGING for another "Atlantic" (number not noted), the line traverses the dock and industrial districts of Dundee for some distance, with frequent overbridges or level crossings where, as the time was just past mid-day, crowds of workmen were crossing or waiting to cross, as they left for dinner. Then alongside the Firth of Tay for some

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distance, the Dundee and Arbroath Joint Line is entered upon. Arbroath was reached in 24 min. from Dundee (17 miles). Thence to Montrose, 13¾ miles, took 21½ min.; again, with adverse gradients of 1 in 100 in places, and giving interesting views of sea and coast here and there. At Montrose the bay is crossed by viaducts spanning its entrance. Between Lunan Bay, south of Montrose, and Hillside to the north, is single track, and train tablets are exchanged at speed. Shortly beyond the latter station is the famous Kinnaber Junction, where after a climb at 1 in 88 and 90, the Caledonian main line is joined. Thence to Aberdeen is, however, far from easy, with frequent adverse gradients each way of 1 in 100 or only a little easier. This section is, however, scenically of great interest, as it follows the coast, for the most part along the cliffs, giving views of rocky islets and picturesque fishing villages or small holiday resorts, or overlooking the North Sea itself. However, the 24½ miles from Montrose to Stonehaven, start to stop, were run in 35 min. 10 sec.; and the final 16¼ miles to Aberdeen occupied 22 min. 40 sec., with a very easy run in to the Joint station.

On a return journey, No. 870, *Bon Accord*, had a load of 4 M.R. bogies, 5 N.B.R. bogies, 1 E.C.J.S. bogie and a four-wheeled van, about 300 tons, and the various start to stop stages were run thus: Aberdeen to Stonehaven, 16¼ miles, 24 min. 50 sec.; Stonehaven to Montrose, 24½ miles, 35 min. 5 sec.; Montrose to Arbroath, 13¾ miles, 22 min. 5 sec.; Arbroath to Dundee, 17 miles, 23 min. 15 sec.; Dundee to Cupar, 14¾ miles, 21 min. 5 sec.; Cupar to Kirkcaldy, 18½ miles, 28 min. 25 sec.; and Kirkcaldy to Waverley, 26 miles, 39 min. 15 sec. In view of the numerous running hindrances, in the shape of junctions and curves, &c., these times are distinctly good, especially as the final arrival in Waverley station was 2 minutes before booked time.

Locomotive Boiler Explosions.

In view of the bursting of the boiler of No. 34, a four-cylinder compound 8-coupled engine, at Buxton, London and North Western Railway, recently, the following statistics in regard to accidents of this class, as quoted by the *Railway Gazette*, will be of interest: "In the annual returns of accidents the entry is widened to cover 'the bursting of boilers or tubes of engines.' Of these there have been 99 reported during the 20 years 1901-20 inclusive, and they resulted in 7 servants being killed and 111 injured. The returns do not differentiate between the bursting of boilers and of tubes, but in all but six cases there were servants injured which suggest that they were serious. All the fatal explosions, with the exception of one on the Taff Vale in 1904, were inquired into by the inspecting officers. The 99 cases have been distributed as follows: Cambrian, 1, Great Central 2, Great Eastern 9, Great Northern 12, Great Western 5, Hull & Barnsley 2, Lancashire & Yorkshire, 13, London & North Western 11, London & South Western 4, London, Brighton & South Coast 2, North Eastern 3, Rhymney 2, South Eastern & Chatham 5, Taff Vale 3, Tyne Improvement Commissioners 2, four other English companies 1 each, Caledonian 2, North British 1, Highland 1, Great Northern of Ireland 8, Great Southern & Western 1, Midland Great Western 1, Northern Counties 1, and four other Irish companies 1 each. It may be noted that in 1917 the railroads of the United States reported 91 boiler explosions, involving 84 deaths and injury to 239; in 1918 there were 27 explosions reported, with 24 killed and 90 injured."

Pre-War Speeds on the Great Western Railway.

A REVIEW of W. J. Scott's booklet describing runs on the Great Western Railway since pre-war schedules were restored on October 3rd, appears in the "Railway Literature" section, and it is interesting to note that one of the runs described was a journey on the 11 a.m. from Paddington to Bristol, made on the same day as the trip recorded by Mr Cecil J. Allen in his December article on "British Locomotive Practice and Performance," although the two recorders were quite unaware of each others presence on the train at the same time. It is a testimony to the accurate work of both that the times are practically in absolute agreement, save for the somewhat obvious error in Mr. Scott's time of passing Maidenhead, which should be a minute less than that shown. The runs with the down "Limited," of which the details are taken from guards' journals, though quite good, even according to the high standards obtaining on the Great Western Railway, fall considerably short of the remarkable journey related by Mr. Allen in the same article, when sixteen minutes were regained between Westbury and Plymouth.

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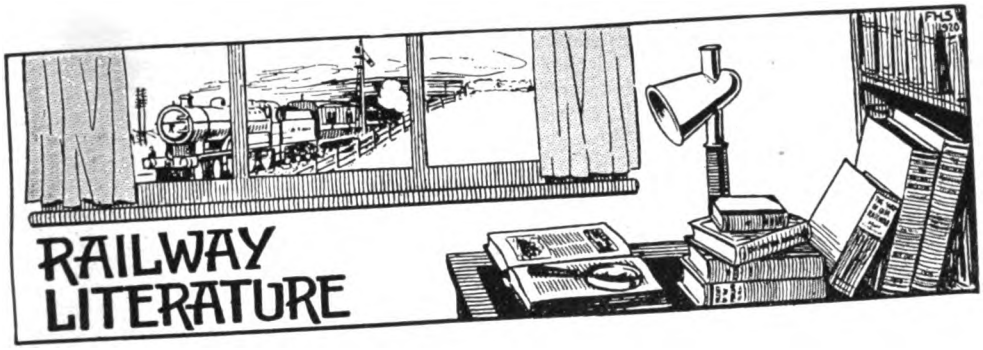

La France. [Published by Evans Brothers, Limited, Montague House, Russell Square, London, W.C. 1. Price 2d. weekly.]

Nos. 1, 2 and 3 of this weekly "revue de la presse française pour tous ceux qui apprennent le français" is designed for the use of schools and colleges, and for those who desire to preserve and develop their French, and at the same time make themselves conversant with the topics of the day in France. As yet only a well-produced and freely illustrated pamphlet, *La France* appears to meet a real need.

Steam Engine Valves and Valve Gears. By E. L. Ahrons. [Sir Isaac Pitman & Sons, Limited, Parker Street, Kingsway, W.C. 2. Price 2s. 6d. net.]

In this volume, described as "for Students, Engine Drivers, Fitters and Others," Mr. Ahrons deals with the functions, construction and operation of valves and valve gears, and the use of valve diagrams, in so far as steam engine practice is concerned. The first chapter deals with the general subject of steam distribution, the second with the simple slide valve and eccentric, the third with modified forms of slide valve, and the fourth with variable cut-off or expansion slide valves. Chapter V explains the preparation and use of valve diagrams, and remaining chapters consider eccentric reversing gears, the Walschaert and Joy gears, Corliss valves and valve gear, drop valves and valve gear, and the "Uniflow" engine.

The Westinghouse Air Brake. [Locomotive Publishing Co., Limited. Price 2s. 6d. net.]

This addition to the useful series of volumes dealing with various aspects of locomotive engineering and associated subjects issued by the publishers, is modestly described as "A Description of the System and its Working." Actually it goes further, within the limits of 80 pages, illustrated by 62 figures and two folding plates, one in colour, to assist explanation. Following a brief history of the brake, the standard fittings and adjuncts are described, and the working of the brake explained. Special forms, such as the electro-pneumatic and "empty and load" brakes receive attention, as also the use of Westinghouse apparatus for electric trains. Operating problems are dealt with as required, and the ruling principle is clearness and simplicity of explanation and description.

Chart of Midland Railway 0-6-0 Locomotives. [The Locomotive Publishing Company Limited. Price 2s. net.] Hitherto the charts issued by this firm have related principally to large and special locomotive designs. That now published deals with one of Sir Henry Fowler's 0-6-0 non-superheated engines, a good straightforward yet relatively simple design, and, therefore, peculiarly suitable for demonstration purposes. As usual every part is numbered, with a complete key.

Proposed Railway Classification of Goods by Merchandise Trains. Chart No. 1. [Hirst & Adamson, 13, Market Cross Chambers, Huddersfield. Price 1s. 6d.] This chart, printed on a stout folding card, is designed to show in convenient tabular form, by means of vertical and horizontal crossing columns, the approximate percentage relationships between the 20 new classes proposed, and (in red) between the existing eight classes. The figures relate to conveyance only, and are based on the conveyance charges authorised by the London and North Western Railway Company's Order Confirmation Act, 1891, for a distance of 50 miles. As the new rates are not yet finally fixed, the figures given are necessarily approximate, but the chart has considerable value for use by firms having to deal with railway transport on a large scale.

Lubrication of Locomotives. By E. L. Ahrons. [Locomotive Publishing Company, Limited. Price 5s. net.]

In this volume, which includes material used for articles published in the pages of *The Locomotive Magazine*, Mr Ahrons deals first with the general qualities of lubricants.

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subsequent chapters discussing various aspects of the subject, such as the friction of lubricated surfaces and bearings, locomotive axle-box and journal bearings, lubrication of axle-boxes, motion, cylinders and valves, &c. Many practical points are dealt with, various lubricants are discussed, and the usual types of lubricators and adjuncts are described, together with examples of application in practice, The book is well produced, with numerous illustrations and several folding plates, and should prove of great use for reference purposes and to those who follow locomotive practice professionally or otherwise.

THE VACUUM AUTOMATIC BRAKE. [Locomotive Publishing Company, Limited. Price 2s. 6d. net.]

This useful little volume describes the principles upon which the vacuum brake operates, leading up to a review of its various forms, adjuncts and special applications. It is designed as a practical reference work for those concerned with brake operation and maintenance, being in fact a second and improved edition of a work previously issued and which has met with wide acceptance. A section deals with the application of vacuum brake apparatus 1or controlling slip carriages. The book is freely illustrated with several folding plates, one in colours to facilitate explanation.

EARTHWORK IN RAILWAY ENGINEERING. By J. W. F. Gardner, M.I.C.E. [Constable & Co., Ltd. Price 15s. net.]

This volume, an addition to the Glasgow Text Books of Civil Engineering, is based largely, as regards examples of practice, upon experience gained by the author (now New Works Assistant to the Chief Engineer of the Caledonian Railway) under Mr. D. A. Matheson, formerly Chief Engineer and now General Manager of that line. Its general purpose is to describe in a practical manner the underlying principles which control earthwork undertakings, so far as they relate to general railway work. The various chapters deal with preliminary investigations and estimates of cost, investigations as to strata, culverts and drainage, execution of earthwork and plant used, slips, maintenance, &c. Within its 152 pages and with the aid of 74 drawings and diagrams, a wide range of practical aspects is considered, though, as the author emphasises, in view of the uncertainty of the material to be met with, no hard and fast scheme of operations can be adhered to, and the methods of procedure set forth should be taken more as guides to what course or design to follow. This volume will be welcomed in practical circles, as it is concerned with a subject which has not received a great deal of press attention, though it figures very prominently in the work of the practical railway engineer.

RESTORED PRE-WAR TRAIN SPEEDS ON THE GREAT WESTERN RAILWAY. By W. J. Scott, B.A., A.M.S.E., &c. Price 1s. net. Post free 1s. 1d.

This pamphlet, copies of which can be obtained from the offices of the RAILWAY MAGAZINE at the prices noted, will be welcomed by all who have known Mr. Scott as a frequent and valued contributor to the pages of the RAILWAY MAGAZINE. As a student of express train-running in all its aspects, peculiarly qualified to deal with matters concerning the Great Western Railway, Mr. Scott's descriptions and records of journeys since the pre-war standard of running was restored, on October 3, by this progressive company, will be appreciated by a wide circle of readers. Special emphasis is laid upon the fact that the schedule time of 105 minutes for the Bath slip off the 11 a.m. ex Paddington, is the fastest booked run in Europe, the distance being 106¾ miles. A run with this train on which time was improved upon fittingly prefaces an interesting series of runs on other principal express trains.

REDUCED SURVEY MAP OF SOUTH AFRICA. [John Bartholomew & Son, Limited. Price 2s. 6d. net.]

This addition to Messrs. Bartholomew's "Geographical Institute" series of reduced survey maps will be welcomed by all interested in South Africa and its development. Clearly printed on good paper, within a folded cover, it is convenient for reference. Inset are plans of Cape Town, Durban and Port Elizabeth.

CARDIFF—"The City of Golden Opportunities for the Manufacturer." Issued by the Development Committee of the Cardiff City Council.

This well-produced volume, copies of which can be obtained on application to the Development Agent (Mr. T. W. D. Smith, late of the Great Central Railway), City Hall, Cardiff, gives a great deal of essential information, with illustrations and a folding plan of the "coal capital." It is, however, emphasised that Cardiff is a centre for many other industries than those associated with coal, and its shipping has a very much wider field. The railways and water facilities of the district are exceptionally good, and copies of this booklet with its suggestive golden cover will be welcomed by manufacturers and traders generally.

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MR. JAMES MILNE, who becomes Assistant to the General Manager, Great Western Railway as from January 1, 1922, is a graduate (B.Sc.) of Manchester University, and served a pupilage in the Great Western locomotive department. Subsequently, he was for some years on the staff of the General Manager and the Superintendent of the Line. In September, 1919, when filling the post of Assistant to the Divisional Traffic Superintendent at Plymouth, Mr. Milne's services were requisitioned by the Minister of Transport.

* * *

WITH regret the death is recorded of Mr. Thomas Addy Wilson, a former General Manager of the Highland Railway, from which post he retired at the end of 1910. Mr. Wilson, who was 70 years of age, received his training on the North Eastern. In 1865 he began work under his father, who was North Eastern stationmaster at Burton Salmon, near Pontefract. Subsequently he went to Newcastle, where for 15 years he was chief clerk to the District Superintendent. His duties covered the passenger working over the larger portion of the North Eastern Division of the railway—the thickly-populated districts of Tyneside, Sunderland and Durham—and also over the country stretching to Berwick on the north and to Carlisle on the west. From Newcastle he went to York to become District Superintendent. Then he became Goods Manager at Newcastle, where he had already served so long in the passenger department, and soon he was called upon to take charge of the whole of the outdoor work connected with the goods department of the system. It was in 1898 that he was appointed to the Highland, and in Inverness his business capacity and administrative talent were appreciated by all interested in the manifold details of railway working. Mr. Wilson was a man of keen commercial instincts and broad sympathies, and he was always most popular with the staffs with whom he was associated, and with the general public. This high esteem in which he was held was well deserved by his unfailing courtesy and his constant endeavour to promote the interest alike of the railway he served and those it employed.

MR. JAMES MILNE,

Appointed Assistant to the General Manager, Great Western Railway, as from January 1, 1922.

* * *

WE record with regret the death of Mr. R. A. Duguid, Superintendent of Aberdeen joint station from 1895 to 1917. During his term of office Mr. Duguid came much in contact with the Royal family on their visits to Balmoral, and for his services in this and other directions received the M.V.O.

* * *

No fewer than 70 members attended the recently-held first annual dinner of the Metropolitan Railway Bowling Club. The chair was taken by Mr. John Wardle, Commercial Manager of the Metropolitan Railway, who is also captain of the club. Mr. Wardle, in proposing the toast of "The Club," remarked that it gave him the opportunity of saying how pleased he was to

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be captain of a club composed of members representing all grades of the Metropolitan Railway staff. Subsequently Mr. Wilson, the Chief Civil Engineer, presented the prizes won by members during the past year.

* * *

THE Great Eastern Railway Musical Society's second concert of the season was held in the Hamilton Hall of the Great Eastern Railway Hotel, Liverpool Street, E.C., on November 30. On this occasion the main portion of the programme was provided by the London section of the Male Voice Choir, who contributed a number of part songs, choruses, &c. The chair was taken by Mrs. John Miller (the wife of the company's Chief Civil Engineer), who was presented with a silver and ivory mallet, suitably inscribed, as a souvenir of the occasion.

* * *

NOTABLE among the many railway war memorials is that recently unveiled in the Glasgow Central station of the Caledonian Railway. The memorial tablet has been placed on the south front of the stone pier, between the arches leading from the concourse to the Gordon Street booking office on the east side of the station. The *motif* of the design is based on the still surviving custom of the early ages, when the soldiers returning from the fields of battle decorated their flags with wreaths of laurel leaves. It is here symbolised in a conventional manner, the tablet having for supporters regimental flags surmounted by a laurel wreath, the symbol of "Victory." The crown at peak of staff represents "The King," and the flag "The Country." Swags of laurel also bind the flags to the central panel of frieze which carries the dedication inscription. The thistles at springing of "reed and band" border are suggestive of the Scottish company, and the branch of palm tree laid on the plinth moulding, underneath the names of those who made the supreme sacrifice, is the symbol of "Peace," as in the ancient days the palm branch was laid on the breast of the dead hero. The tablet, which contains 706 names and at least 7,000 letters, was cast in one piece. Each letter was modelled separately by hand and separately chased by hand after being cast in the bronze. The size is 7 ft. 2 in. by 5 ft. 2 in., and the weight about 8 cwt. The bronze has a florentine finish, with the tops of the letters brightly polished, so that

CALEDONIAN RAILWAY WAR MEMORIAL.
Scene at the Unveiling at Glasgow Central Station.

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the names may be easily read. From ground to top of cornice the tablet measures 10 ft. 2 in. The inscription reads as follows:—

TO THE HONOURED MEMORY OF THE MEN
OF
THE CALEDONIAN RAILWAY
WHO GAVE THEIR LIVES FOR THEIR COUNTRY
IN THE GREAT WAR,
1914–1918.

The unveiling was performed by General Sir Francis Davis, G.O.C.-in-C. for Scotland, and among those present were Mr. Henry Allan, Chairman of the Caledonian Railway, Mr. William Younger, Deputy-Chairman, and other directors, also Mr. Donald A. Matheson, General Manager, and his chief officers.

* * *

IN connection with the recent unveiling of the Caledonian Railway war memorial at Glasgow Central station, it may be mentioned that the number of men who joined the colours from all the various departments of the service, including the hotels, canals and docks and the Caledonian Steam Packet Company, totalled 5,339, or 23·1 per cent. of the normal staff, and the number who made the supreme sacrifice was 706, or 13·2 per cent. of the total who joined the forces. Of the 80 members of the staff who held commissions, 1 Lieut.-Colonel, 3 Captains, 8 Lieutenants, 6 Second-Lieutenants, and 1 Engineer-Lieutenant, R.N.R., lost their lives. Of the 162 honours—from Distinguished Service Order downward—awarded to members of the company's staff, 14 were gained by men who fell. The chairman and directors of the company invited two relatives of each of the men who fell in the war to be present at the unveiling ceremony, and all ex-service members of the staff who could be spared from their duties had permission to attend.

* * *

THE Railways Amalgamation Tribunal announce that, in accordance with Section 10 of the Railways Act, 1921, they have appointed as Clerk of the Tribunal Sir Henry Allan Holden Steward, barrister-at-law, who is at present the Chairman of the Light Railway Commission. The offices and address of the Tribunal will be at: 1, Horse Guards' Avenue, Whitehall, S.W. 1.

* * *

THE first social gathering of the newly-formed Institute of Transport Metropolitan Graduate and Student Society was held on December 6 in the Essex Room at Liverpool Street Station Hotel. Sir Henry Maybury, K.C.M.G., C.B., President of the Institute of Transport, occupied the chair, and was supported by Mr. H. H. Gordon, L.C.C., and Mr. Roger T. Smith, Electrical Engineer, Great Western Railway. Well-rendered musical and other selections were provided by Miss Winifred Ceci, Miss Lillian Lord, and Messrs. G. E. Ceci, Herbert Richards, Mike Eman, W. Barclay Browne, Bertram Bray, and "Frank Milton and Jerry," in most cases attracting well-deserved encores. During the proceedings Mr. H. H. Gordon (chairman of the society) moved that the "most cordial thanks of the meeting be given to the President of the Institute for his attendance at their first social function," and referred to the great personal interest he had taken in the society, as well as in the work of the Institute as a whole. Mr. F. W. Wheddon, Vice-Chairman of the Society, seconded the proposal. Sir Henry Maybury, in reply, remarked that when the Institute was formed he saw great possibilities for the younger men engaged in transport services. He wanted to see the Institute of Transport a real factor in the interests of its members. They hoped in the early spring to hold a big Congress in London. He looked forward to the time when the Institute would have 10,000 and not 1,000 members. Mr. Alex. J. Webb, Hon. Secretary of the Society, and his Committee, are to be congratulated upon the success of the function in every respect.

* * *

AT the Railway Club, 65, Belgrave Road, S.W.1., at the December general meeting the Rt. Hon. Lord Monkswell, favoured a large gathering with an excellent paper entitled "The Making-up of Lost Time." The lecturer emphasized the wastefulness of unpunctuality and outlined the definite encouragement given to engine drivers in certain Continental countries to make up lost time and still pay due regard to safe-working and fuel economy. Lord Monkswell stated that in his opinion the rule book instructions given to British locomotive drivers were far too vague. An animated discussion followed Lord Monkswell's lecture. The proceedings terminated with hearty votes of thanks to Lord Monkswell for his extremely interesting and valuable paper, and to Mr. Cecil J. Allen, who occupied the chair.

* * *

FOR some time past experiments have been carried out at Victoria Station (District Railway) with an automatic syren in connection with the starting of trains. The experiments having proved satisfactory in the speeding up of the services, it is proposed at an early date to introduce similar syrens at Charing Cross (District Railway), Totten-

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ham Court Road (Hampstead Railway), and Elephant and Castle (City & South London Railway). These syrens can be set to give a sound signal at any prescribed number of seconds' interval.

* * *

In the *Edinburgh Gazette* a notice recently appeared that application is intended to be made to the Secretary for Scotland by the Highland Railway Company for a Provisional Order under the Private Legislation Procedure (Scotland) Act, 1899. The purposes of the Order are (i) to extend further the time limited by the Highland Railway (Additional Powers) Act, 1897, for the completion of Railways 1, 2 and 3 authorised by that Act; and (ii) to confirm the purchase of lands at the following stations:—Achnashellach, Aviemore, Brora, Foulis, Invergordon, Kinloss, Lairg, Mound and Murthly; and also at Acheilidh crossing loop (between Lairg and Rogart), Achnasheen, and Kirkton level crossing.

* * *

For the convenience of West End hotel and restaurant staffs the Underground are running special late trains on weekdays from Piccadilly Circus, leaving that station 20 minutes after the last ordinary trains for Hammersmith and Queen's Park. For passengers using these special late trains the Piccadilly entrance to the station is kept open. It is desired that the public should understand and remember this arrangement. It takes half an hour to close down a large and busy station such as Piccadilly Circus at the end of the day, and it is therefore necessary for the station staff to commence the work of closing down as soon as the last ordinary train has left. But the Piccadilly entrance remains open so long as there is time to catch the special late trains.

* * *

It is now possible to give further details of the new second-saving scheme which the Underground are putting to the test of a public trial at Kilburn Park station on the Bakerloo Line. The Underground have long recognised that both delay and inconvenience arise from the old system of issuing tickets to passengers and the examination and cancellation which immediately follows the issue. Where millions of passengers have to be transported daily, mainly during two short morning and evening periods, any device which may save a fraction of a second per passenger is, in the aggregate, an enormous gain in facility of operation. Automatic slot ticket machines, improved barriers, windows set apart for money-changing, circular booking offices, machines for printing and issuing tickets for the booking offices, are but a few examples of systems and devices which have been tried, all with the same object, generally with good results. Of the "passimeter" system much is hoped. It involves the use of three separate registering cyclometers; two automatic, one non-automatic. The first registers the dating and cancellation of each ticket, setting the passengers free to proceed through the "passimeter," whereby another cyclometer automatically records his passage. With the third cyclometer the booking clerk registers the passage of the season ticket holders. From the "passimeter" the traveller goes straight on to the lift, escalator or platform, as the case may be, without any ticket examination at the customary barrier, this source of delay and inconvenience being entirely got rid of, though ticket collection is still carried out in the usual way. The experimental offices at Kilburn Park station are equipped with an "automaticket" machine similar to the one recently tested with success at Leicester Square station. Local tickets, which represent 75 per cent. of the issues, are delivered from this machine by a method which is simplicity itself. By the pressing of a plunger, like that of an electric bell push, the booking clerk can issue any number of tickets up to five of any one denomination. In fact, the machine can deliver five tickets just as quickly as one, and far more quickly than one ticket can be issued in the ordinary way. The combined automaticket and passimeter booking office at Kilburn Park is designed to provide quarters for the booking clerk, and, by attention in construction, every available inch of space has been put to use. Even the ledger desk is made to the exact size of the ledger. There is no waste space, and a stock of 250 different kinds of tickets is located so that all are within easy reach. Experiment is also to be made with steel ticket cases in place of the ordinary wooden holders, with a view to further space-saving and greater cleanliness.

* * *

Known as "The Sunny South Special," the popular through train between the North of England and the South Coast has been again put into service every weekday on and from December 1, leaving Liverpool (Lime Street) 10 a.m., Manchester (London Road) 10.15 a.m., and Birmingham (New Street) 11.38 a.m., with connections from other important towns *en route*, and arriving at Brighton 3.56 p.m. and Eastbourne 4.50 p.m. In the reverse direction the train leaves Eastbourne 11.35 a.m.,

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Brighton 12.25 p.m., arriving at Birmingham 4.40 p.m., Manchester 6.55 p.m., and Liverpool 6.35 p.m. Connections are made at Brighton with other South Coast towns, both going and returning.

* * *

In order to meet the wishes of London, Brighton and South Coast Railway travellers the 9.45 a.m. third-class Pullman express from Victoria to Brighton every Sunday now calls at Clapham Junction, 9.52 a.m., returning from Brighton 6.35 p.m. The cheap fare including Pullman Car from Clapham Junction, is 12*s*.

* * *

"Underground" calendars are all notable for their artistic qualities, and each year strike a novel note. For 1922 alternate monthly cards bear reproductions in colour of "London Characters," the intermediate ones giving quotations from various writers on English scenery, places within the scope of "Underground" facilities, or aspects of London life. A backing card gives collective calendars for 1921, 1922 and 1923, and useful reference material. The "Underground" publicity department can be congratulated on its 1922 calendar with every justification.

* * *

A new edition of "The Vigilance Booklet" has been issued from the office of the Caledonian Railway General Manager, Glasgow. It is well worthy of close study by all who are employed in the railway service, but particularly by those engaged in actual railway operation and in the company's workshops. Combined with common sense, prudence and the instinct of self-preservation, the acceptance of the rules of conduct and the hints and information given in this profusely illustrated and well-written booklet, much may be done to reduce the lamentable number of personal accidents in railway work.

* * *

At the European Time-table Conference, recently held in Berne, a great deal of attention was directed, at the instance of the South Eastern & Chatham Railway Company's representatives, to the many detentions and inconveniences travellers are subjected to by the Passport and Customs Authorities when passing from one Continental country to another. The discussion showed that, at the majority of the European frontiers, two examinations, almost identical, have to be gone through, the former taking place at the last railway station before leaving the country, and the latter at the first railway station entering the adjacent country. This dual examination appears to be caused by the foreign Governments concerned not emulating the example of the French and Swiss Governments at Bale, where, in the magnificent Central Station, the officials of both countries, practically side by side, get through their respective formalities in a few minutes. Travellers to Switzerland by the Bale route last winter, as well as the previous summer and winter, will remember the inconvenience of the turn-out in the early hours of the morning, and be thankful for the influences which have brought about the excellent arrangements now working so well at Bale. It is to be hoped that an amelioration of the conditions at all frontiers will speedily result from these deliberations, and the South Eastern & Chatham Railway may have the satisfaction that their further effort to make Continental travel easier has been successful.

* * *

At the same Conference the question of Summer Time was considered, and the representatives of the British railways, in common with the French, Belgian and Dutch companies, were unanimously of the opinion that all countries, adopting Summer Time in 1922 should begin it and end it on the same dates, as the lack of synchronisation hitherto prevailing in this respect has caused much confusion and interference with international travel. Among the improvements secured for Continental travellers next year may be mentioned a special Easter train to Switzerland *via* Boulogne and Laon, express services to Oberammergau, for the Passion Play, not only *via* Munich, but also *via* Innsbruck and the Tyrol; an additional service to Brussels *via* Dover and Calais, leaving London in the afternoon, and a through carriage (first and second-class) from Boulogne to Venice and Trieste, with a sleeping car for passengers sailing from the Italian ports to Egypt, India, &c. A further great achievement on the part of the British representatives was the securing of a London connection with the Simplon-Orient train de luxe, off the 11 a.m. Calais service from Victoria, instead of off the 8.30 a.m. This will take place from June 1 next, and as the departure time from Paris will not be altered, it will be possible for passengers travelling to the Near East not only to leave London at a much more convenient hour, but also to save 2½ hours in transit.

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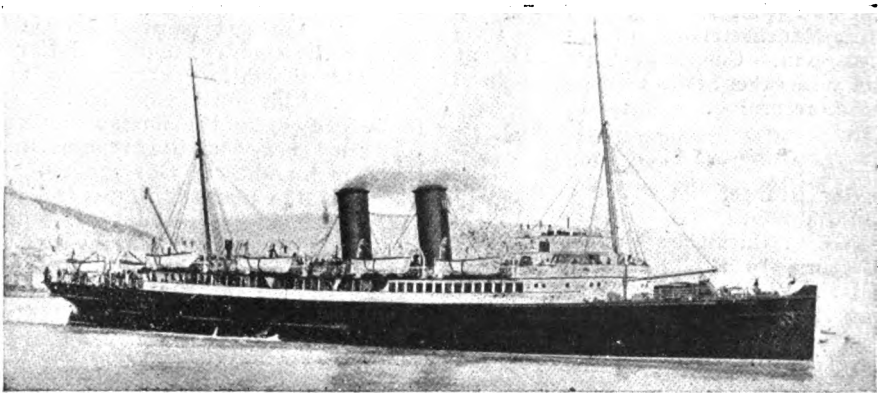

SOUTH EASTERN & CHATHAM RAILWAY CROSS-CHANNEL TURBINE STEAMER "BIARRITZ."

ABOVE is illustrated the latest addition to the South Eastern & Chatham Railway Company's fleet of cross-Channel turbine steamers, the *Biarritz*. The vessel takes her place in the Dover–Calais service as from Christmas Eve, 1921. The *Biarritz*, a sister ship of the *Maid of Orleans*, well known to Continental travellers, was taken by the Government and fitted as a minelayer. She was employed in home waters for some time, assisting in the attacks on the Belgian Coast. When the Grand Fleet was ordered out the *Biarritz* was the first to get away. Afterwards ordered to the Mediterranean, she laid the mines which blew up the *Breslau*, and also mined the *Goeben*. The vessel was handed back to the company's control for trooping service on April 23, 1919, and continued so to act until trooping ceased on May 4, 1920, and was sent to Barrow-in-Furness for reconditioning. She is 348 ft. long by 42 ft. wide, and 25 ft. deep to awning deck, with bilge keels, and two large beltings to obviate the possibility of any damage to the structure of the vessel when berthing.

Special provision has been made for the carriage of motor cars, and to save time in the handling of baggage, this is packed in large vans, which are lifted bodily by the ship's derricks and lowered into the hold.

Built to the requirements of the British Board of Trade as regards life-saving appliances and water-tight sub-division, the vessel is divided into twelve watertight compartments, the transverse bulkheads rising to the main deck without any openings, except three which have watertight doors fitted with gear capable of control by the officer on the bridge. Wireless telegraphy has been fitted.

The vessel is certified to carry 1,000 first-class and 400 second-class passengers. For first-class passengers who may desire to have private cabins, there are 20 two-berth staterooms on an awning deck, two of which are special staterooms, the cabins being so arranged as to be capable of being converted into one large cabin.

On the fore part of the awning deck there is a large and commodious smoking-room and first-class bar. This is panelled in polished oak, with leaded stained glass windows. The overhead panelling is in plaster, handsomely ornamented, and the large open fireplace with basket grate is fitted with an electric log fire.

A first-class restaurant on the after-end of the awning deck will accommodate 72 diners. This saloon is decorated in white enamel, with polished mahogany wind screens, and has a service bar, an electric hot plate, and a large pantry. The second-class dining saloon on the main deck aft will seat 32 diners. On the main deck forward a large saloon is reserved for first-class lady passengers, and is so constructed that the windows may be kept open in almost any weather. A similar but smaller saloon is fitted amidships for second-class lady passengers. On the lower deck, lying down accommodation is provided for 57 first-class gentlemen, whilst aft there is a second-class gentlemen's saloon with lying down accommodation for 44 passengers.

The whole of the arrangements are of a most luxurious character.

Below is a record of the ordinary cross-Channel run :—

Distance	20 miles.
Time	50 minutes.
Speed	24 knots.
Time from quay to quay	1 hour 10 min.
Coal during full-speed period.	5 tons 5 cwt.
Air-pressure ..	½-in.
Vacuum	28 in.
Revolutions ..	296.
Coal	Welsh.
Mean draught ..	11 ft. 10 in.
Bunker capacity ..	140 tons.

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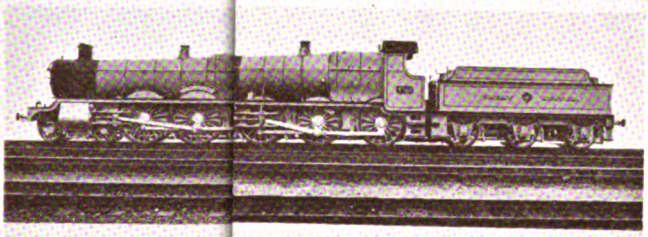

_ 2900 CLAS300 CLASS _ 5-8 WHEELS _

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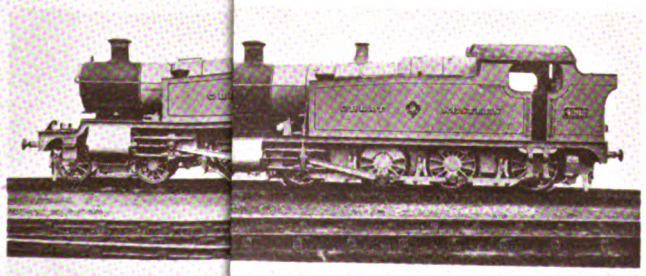

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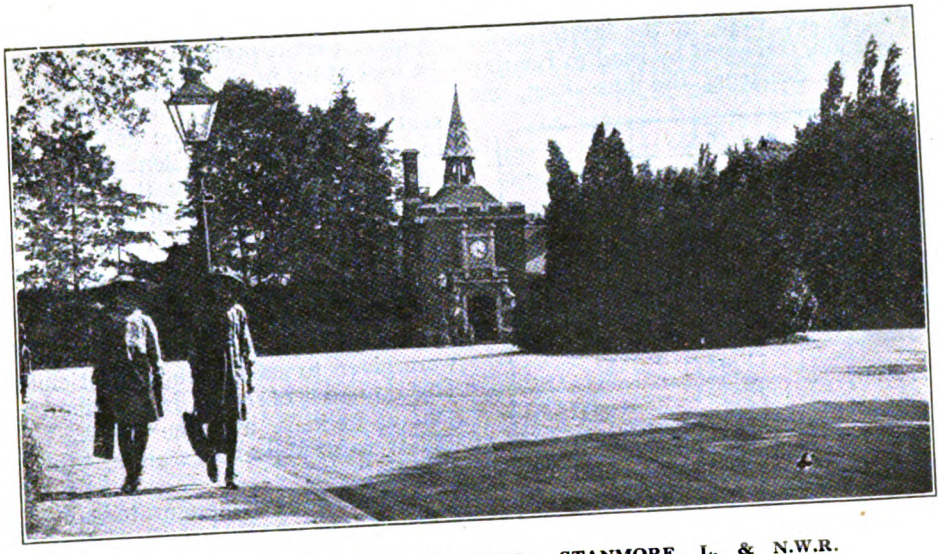

A PICTURESQUE STATION EXTERIOR: STANMORE, L. & N.W.R.

The Stanmore Railway.

By W. E. EDWARDS.

THE branch railway, two miles and three furlongs in length, extending from Harrow and Wealdstone. station, London & North Western Railway, to the village of Great Stanmore, affords yet another example of private enterprise which, in the past, has provided so many towns and villages with means of transit, the lack of which is but very imperfectly realised by the generation of the present day.

This line owes its origin to Mr. Fredk. Gordon, of Bentley Priory, who, it is stated, first saw a preliminary plan of the railway during the year 1885. Subsequently Mr. W. B. Myers, M.I.C.E., F.G.S., was entrusted with the laying out of a line (in cutting) running westward of Belmont via Hill House and Bamford's Corner, thence continuing round the north side of Stanmore Park Mansion. In consequence thereof, notice of opposition was given by the owner, but, nothing daunted, Mr. Gordon thereupon decided to purchase the estate. Next the owners and residents were approached, but the result was disappointing as far as the raising of capital was concerned, so ultimately, therefore, the London and North Western Railway was consulted with a view to working the line, and its consent was obtained, on terms, however, virtually requiring Mr. Gordon to provide nine-tenths of the necessary capital.

Mr. Myers was now instructed to lay a less costly line with the proviso that the beauty of the surroundings should not be destroyed in the process; a condition happily maintaining at the present time. Under the new scheme the railway was deviated via the rifle butts and Kenton Lane Farm, passing thence to a terminus in Church Lane (Stanmore) below the Vicarage, at a level of, approximately, 94 ft. above that of the junction at Harrow. A contract was let to Mr. Chas. Braddock, of Wigan, and the first sod of the new railway was cut by Mrs. Gordon upon the site of the terminus as above noted.

On Thursday, December 18, 1890, the line was formally opened, special trains, it is recorded, proceeding from Harrow, having their engines decorated by evergreens and the stations decked in bunting, the arrivals being greeted by merry peals from the church bells and the music of

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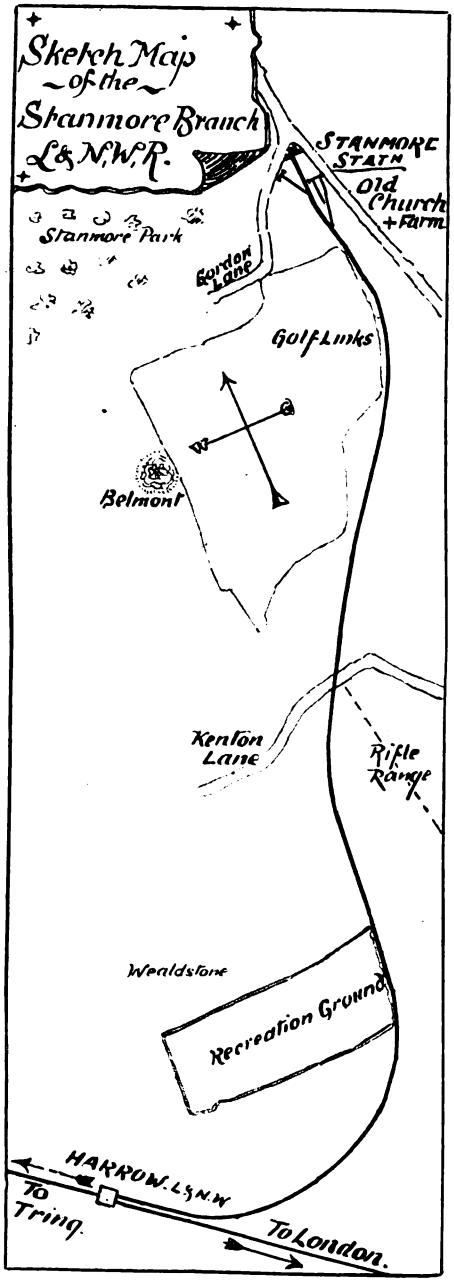
the Harrow Town Band. Visitors to the number of 400 were, at the invitation of Mrs. Gordon, conveyed by road to Bentley Priory. In declaring the line open, Sir



George Findlay, General Manager of the London and North Western Railway, observed that Stanmore owed much to Mr. Fredk. Gordon, whilst the latter gentleman, in responding, expressed the opinion that a profitable return must not be looked for in the immediate future.

As a souvenir Lady Findlay was presented with a handsome gold brooch set in diamonds. An excellent programme of music was provided by the band of the Scots Guards. The bellringers of Stanmore, other men of the village, as well as the contractors' employees, were given a "good dinner" in the new goods shed. New shillings were presented to the mothers and older women, whilst new sixpences were given to each of the school children. The day was observed in Stanmore as a general holiday, and the trains, we are told, were, as well as the station, "thronged all day."

The railway thus inaugurated consists of a single line of the length of two miles three furlongs, as before stated, and it is worked under the "one staff" system. It terminates in a bay platform line at Harrow upon the up side, and runs parallel with the main lines Londonward for some distance. The rails then take a well nigh semi-circular course north-eastward, passing the Recreation Ground, the rifle range and Belmont, and by no route, perhaps, are the still unspoiled beauties of rural Middlesex seen to greater advantage than that taken by the Stanmore line. Upon the appended sketch diagram may be noted the position, just outside the terminus, of Old Church Farm. Many readers are aware that Stanmore possesses, side by side, two parish churches, the one ancient, the other modern. Upon the actual site of the terminus, or in the immediate vicinity, once stood a still older church, owing to which fact the farm house in question derives that appellation.

Stanmore station was designed, not unsuccessfully, to harmonise with its natural surroundings. For that reason it may be mentioned that originally an open ground frame, supplied by a well-known firm of signal engineers, stood at the platform end. The structure was therefore "invested with artistic merit" as far as the circumstances allowed. However it is now superseded by a standard pattern London and North Western Railway frame at the Harrow end of the yard.

By reference to the diagram the picturesque situation of the little terminus,

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immediately within the fork of two roads, may be observed; it lies at the foot of the steep hill which rises to the breezy heights of Bushey Heath; while adjoining, on the western side, is Stanmore Park, formerly the seat of the Drummonds, and but a short distance off in the opposite direction, is Canons Park, once the residence of the Bishops of London. Readily accessible is the wild woodland scenery of Stanmore Heath, while Stanmore Common, glorious in gorse and heather, commands views over a wide expanse of country; neither should the aforementioned Bentley Priory, once the residence, 1848, of the Dowager Queen Adelaide, be omitted.

The former branch passenger train is now replaced, as elsewhere, by the rail-motor system, and despite the recent competition of the motor omnibus serving Harrow, Pinner, Bushey and Watford, a daily service of some 30 regular trains is maintained upon the Stanmore line in each direction. No Sunday bookings, however, exist at present.

A HISTORIC OLD LOCOMOTIVE IN MODERN GUISE.

BEATTIE TANK ENGINE, No. 314, LONDON & SOUTH WESTERN RAILWAY, REBUILT WITH DRUMMOND BOILER BY MR. R. W. URIE.

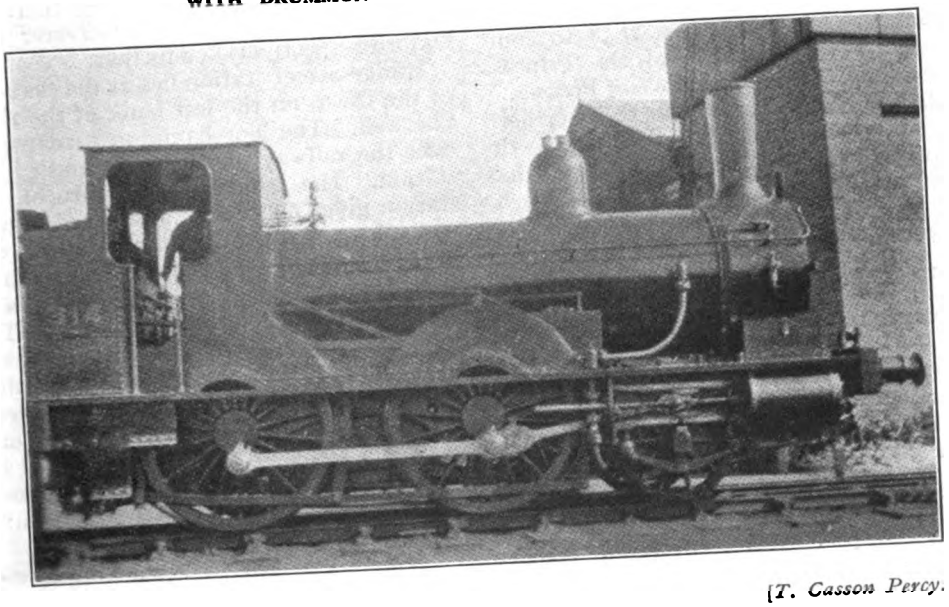

Photo.] [*T. Casson Percy.*

THREE of these engines, built in the period 1863-1874, are still in service at Wadebridge for working the Wensford branch of the old Bodmin and Wadebridge Railway. This section, noted for its curvature among most picturesque surroundings, is used for china clay traffic, trains running as required. When not thus employed these engines are utilised for local traffic purposes in the Wadebridge district, but on the Wensford line no larger engines can be run.

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Banbury as a Railway Centre.

By JOHN DUMMELOW.

WHO has not heard of Banbury, with its celebrated Cross and its perhaps more celebrated cakes, banished for four years by "D.O.R.A." but now once more gladdening the heart of the native and visitor alike? Banbury is one of the pleasantest little towns of the south midlands, and on market-day it presents a very lively appearance with its open-air stalls in the market-place and its cattle and sheep markets. The town manufactures plush and agricultural implements; it was formerly larger, over 13,000 inhabitants, but it is gradually recovering its old prosperity. The original Cross fell a victim to the Puritanical zeal for which Banbury was so notorious at the end of Elizabeth's reign, and the present monument was erected in 1858 to commemorate the marriage of the Princess Royal with the Crown Prince of Prussia.

Banbury is situated in the northern extremity of Oxfordshire, adjoining Northamptonshire, from which a small part has been cut off and included in the borough. The town lies on the right bank of the Cherwell, but an adjoining suburb (Grimsbury) lies across the river. The Oxford Canal, which runs alongside river and railway, provides Banbury with a waterway to most parts of the country. The railway stations lie between Banbury and Grimsbury.

Banbury is easily accessible by rail, from north, south and west; it possesses two railway stations, on the Great Western and London & North Western Railways, respectively. Bridge Street, the Great Western station, is also served by Great Central trains, while Merton Street is used by Stratford-upon-Avon and Midland Junction Railway trains

Bridge Street station is on the Oxford-Birmingham line of the Great Western Railway, 22¾ miles from the former and 43 miles from the latter station. Until 1910 this was the main Paddington to Birmingham line, but the new direct line *via* Bicester has considerably shortened the distance. The Bicester line was opened in 1910; it gave the Great Western Railway the shortest routes from London to Banbury, Leamington Spa, and Birmingham. By this route Banbury is 67½ miles from Paddington, as compared with 86¼ miles *via* Oxford, and 77¼ miles from Euston.

At Banbury Junction a branch of the Great Central Railway joins the Great Western on the up side. This branch leaves the main line at Culworth Junction (about 1 mile 70 chains south of Woodford and Hinton station). The Great Central has running powers into Banbury station, but although Banbury is a lesser-principal station its limited accommodation renders it unsuitable as a frontier-point for through traffic, and trains and train crews therefore usually work through to Leicester and Oxford respectively, or further

Bridge Street station lies at the east end of the town, on the left bank of the river Cherwell. The Northampton road passes over the railway at the north end of the station. The general appearance of the station gives one an impression of abnormally long platforms; this is due to the small proportion of the station which is under cover—the platforms have been lengthened although the roof has not. The exterior is not imposing, but the age of the station is a good excuse for its being rather old-fashioned; it was constructed between 1845 and 1850 and was opened near the end of 1851. The central part is protected by a "queenpost" roof. There are two main running roads through the station and three bay roads.

On entering the station, one passes through the booking-hall on to the down platform. This is 640 ft. long, and has an average breadth of 18 ft.; on it are the usual station offices, refreshment rooms, &c. At the back of this platform is a bay road (441 ft. long), which connects with the down line (northward); near this end of the platform is a water column.

The through road is used by all down trains except those starting from Banbury. There are main line fasts and semi-fasts; locals on the Oxford-Birmingham, Bicester

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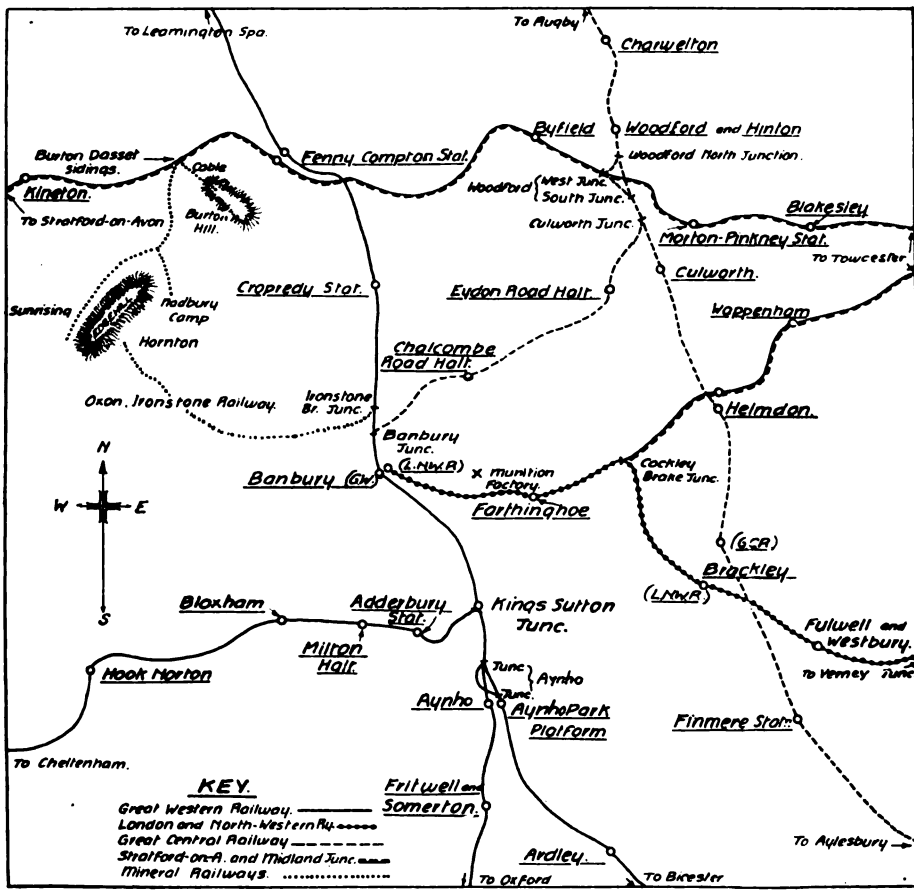
and Chipping Norton lines; and through expresses to the Great Central Railway *via* Woodford. Great Western locals to Leamington Spa and Great Central locals to Woodford and Hinton usually start from the bay, but this is not an invariable rule.

The up platform is reached by a footbridge. This platform is 1,010 ft. long, and at the back of it are two bays of which



MAP OF RAILWAYS IN THE BANBURY DISTRICT.

the northern is about 440 ft. long, while the southern is some 20 ft. shorter. Up trains from Banbury to the Oxford, Bicester or Cheltenham lines use the south bay; all Great Central trains terminating at Banbury arrive at the north bay. The through road is used by all other up trains, consisting of main line fasts and semi-fasts, locals on the Oxford-Birmingham line (including those terminating at Banbury) and through expresses from the Great Central to the Great Western line. Near the south end (which extends some 370 ft. beyond the down platform) are two water-columns, and the single-line "exchange" to the London & North Western Railway may be seen a short distance away.

The Great Western goods station lies on the down side at the south end of the passenger station. Two tracks run through the shed, which is equipped with three 36-cwt. cranes and one 10-ton crane. Behind the up platform are the coal and cattle wharves; they are reached by a short private road from the east end of the bridge. The station sidings (comprising marshalling, mileage and cripple sidings) can accommodate about 1,700 wagons. About a quarter of a mile south of the passenger

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station lie the locomotive sheds ; 36 engines are usually stationed here. There are four signal-boxes containing 66, 89, 78 and 39 levers respectively. Mr. William Cave of 8, Bridge Street is the Great Western and Great Central carting agent.

The present station-master, Mr. F. Revening succeeded Mr. J. Short, retired, in July, 1920. He was station-master at Henley-in-Arden from September 1901 to October 1906, when he took charge of the passenger and goods departments at Tyseley. The Banbury Goods Agent is Mr. H. Lewis.

During the war period all the London trains between Wolverhampton, Manchester and Birkenhead and Bournemouth, Portsmouth and Weymouth. Local trains radiate over all the routes which centre upon Banbury, and it is therefore an important traffic centre.

Great Central through trains include the Newcastle-Swansea restaurant car expresses which have succeeded the pre-war Newcastle-Barry trains, while other services run between Leicester and Banbury, Mansfield and Banbury, Newcastle and Bournemouth, and York to Bristol, with Sunday through trains between Sheffield and Didcot. Recent additions

GREAT WESTERN RAILWAY STATION AT BANBURY.

Birmingham non-stop trains were altered to call at Banbury, where, previously, most of those in the down direction slipped carriages, and with a few exceptions, all trains continue to call. In the down direction the 2.20 and 6.5 p.m. expresses from Paddington now serve Banbury by slip carriage, while the 10.40 a.m. train passes it altogether, but otherwise Banbury is served by all trains. In the up direction, the 9 a.m., 12.15, 6 and 7.50 p.m. expresses from Birmingham, the last-mentioned travelling *via* Oxford, do not call at Banbury. The best services are those *via* Bicester, but there are also good trains following the Oxford route. There are also through are the Aberdeen-Penzance, Edinburgh-Southampton and Bournemouth and Newcastle and Bradford and other through services. There are also local connecting trains between Woodford and Banbury.

Merton Street station is the terminus of a single line branch of the London & North Western Railway. This branch leaves the main line as a double track at Bletchley and divides at Verney Junction (9¼ miles from Bletchley) ; one branch turns southward to Oxford and the other goes north to Banbury. At Cockley Brake Junction (1½ miles east of Farthinghoe station) the Stratford-upon-Avon & Midland Junction Railway joins the London and North Western line over which it has running

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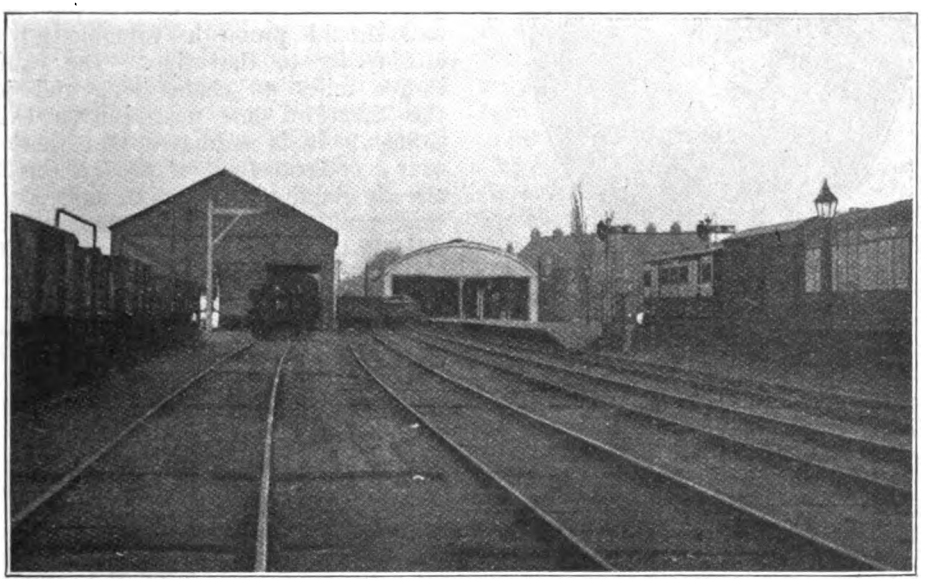
powers to Banbury, and this provides the shortest route for traffic from Banbury and stations south thereof to the north *via* Towcester and Blisworth. At Towcester the Stratford-on-Avon and Midland Junction Railway divides—one line extends to Olney, where a junction is made with the Midland Railway, the other running west to Broom Junction, *via* Byfield and Stratford-on-Avon. At Broom Junction, the S.M.J., as it is commonly styled, again joins the Midland Railway and a route is thus given from South Wales and Bristol to London. In addition to linking up the Midland line at Broom and Olney and the London and North Western at Banbury and Blisworth, thus providing very much shortened routes, thousands of passengers travel annually *via* the S.M.J. Railway to Stratford-on-Avon for the Shakespeare Country.



LONDON & NORTH WESTERN RAILWAY STATION AT BANBURY.

Merton Street station was opened on May 1, 1851, and is about nine months older than its Great Western companion. It has one double-sided terminal platform, which is used in common by the two railways. The circulating area and part of the platform are spanned by an arched roof of corrugated iron, the platform is about 150 yards long and extends some distance beyond the roof. The locomotive shed is to the south of the station on the up side; it has accommodation for eight engines, but at present nearly all the working is done from Bletchley, so that only one is stationed at Banbury. Train staff working is in force for the Blisworth trains, but for London & North Western trains the electric staff is used to Verney Junction. The station staff includes the stationmaster, two booking clerks, eight goods clerks, and 26 outside men. The stationmaster, Mr. E. J. Haslop, entered the company's service at Cambridge in 1880; he then served as chief goods clerk at Rickmansworth, Leighton Buzzard and Higham Ferrers, and came to Banbury in the same capacity in 1892. In 1904 he was promoted to be stationmaster.

The main entrance to the station is through the booking hall, but there is also access on the west side. The goods station is on the down side of the line; it contains three 30-cwt. cranes and one stationary 5-ton crane. Near it is the connecting line or "exchange" to the Great Western Railway; the larger half of this line is owned by the London & North Western Railway, and a gate across defines the boundary. An emergency connection is provided by the sidings from each line to the gas works, which lie between the railways.

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There are eight cattle pens with accommodation for loading or unloading 13 cattle trucks at once, and there is siding

MR. F. REVENING.
Great Western Railway Stationmaster, Banbury.

accommodation for 34 more. There are also facilities for dealing with horses and carriages. The station has accommodation for 217 wagons. A tank near the engine shed is supplied with spring water from Farthinghoe Cut; near this tank there is also a turntable. The signal box is fitted with a 30-lever frame containing 28 levers. The company does its own carting; the stables have accommodation for nine horses.

Train services are not very frequent, consisting of four trains from Bletchley or Verney Junction, and a local on Thursdays from Brackley, and five up trains. On Sundays there is one each way. Stratford-upon-Avon and Midland Junction trains between Banbury and Blisworth (where a special bay is reserved for them) number two daily each way.

The chief mineral in the neighbourhood of Banbury is ironstone and the Edgehill district is an important source of the ore. Two mineral railways are under construction and there is also a cable railway to take the ore on its first stage to the furnaces of South Wales.

About half-way between Kineton and Fenny Compton stations, on the Stratford-upon-Avon and Midland Junction Railway, are the Burton Dasset sidings which communicate by means of a cable some 90 chains long with the ironstone quarries at the top of Burton Hill. For the last few years the quarries have lain derelict, as the quantity of ore yielded was not sufficient to repay the cost of working, but they have recently been reopened.

A pleasing contrast to this scene is the Edgehill Light Railway, the order for which was confirmed early in 1919. This railway (whose chief officers are those of the Stratford-upon-Avon and Midland Junction Railway) is nearing completion and should prove a valuable adjunct and feeder to that line. The railway is five miles 58 chains long and joins the Stratford line near Burton Dasset sidings. It is estimated that there are over 8,000,000 tons of ore on the land already acquired by blast furnace proprietors, and great developments are confidently expected from other areas within siding distance of the new railway; it ends

MR. E. J. HASLOP.
London & North Western Railway Stationmaster, Banbury.

near Nadbury Camp and Sunrising at the bottom of Edgehill.

The third mineral line leaves the Great

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Western Railway on the down side at Ironstone Branch Box. It was promoted by the Oxfordshire Ironstone Company (Manager, Mr. Alex. Mackay) to develop districts on the east side of Edgehill; the contractors were Messrs. Topham & Jones. The railway is of standard gauge and ends near Hornton. The local offices of the company are in High Street, Banbury.

Communication between Banbury and the north-eastern counties and the east coast route to Scotland is provided by the Great Central Railway—or by the Midland Railway (*via* Birmingham)—to Sheffield and York. An alternative route to Scotland is by the London & North Western Railway *via* Birmingham or Crewe; this is the best way to all parts of Lancashire, except Liverpool which is easily reached from Birkenhead, to which expresses run from Paddington and Bournemouth *via* Banbury.

For North Wales the route is *via* Chester (thence London & North Western Railway), there are also Great Western through carriages, and, in the season, through trains to and from Barmouth, Aberystwyth and Llandrindod Wells. The most direct route to South Wales is *via* Cheltenham and Gloucester, but the quickest times are *via* Didcot and the Severn Tunnel. The last route may be utilised for Ireland, but it is somewhat quicker to travel by the London & North Western *via* Birmingham, Crewe, Chester and Holyhead, or by the Great Western to Chester and thence to Holyhead.

The opening in 1910 of the Ashendon-Aynho line of the Great Western Railway provided Banbury with a splendid service to and from Paddington, including several hour-and-a-half non-stop trains. Till 1917 there were slip carriages (now restored) for Banbury, but their withdrawal rather improved the service than otherwise as, of course, they could only set down passengers.

This article would be incomplete without some mention of the splendid work performed by the Station Committee of the Banbury Branch of the Red Cross. Banbury was one of the first towns to supply refreshments to troops while going to or returning from the war, and many thousands of men were provided for in this way. The work was carried out by voluntary subscriptions and £700 was collected on the station. The sisters were most self-sacrificing in their efforts and recognition of the excellence of their work came from all quarters. The work included attendance upon ambulance trains, Banbury being for a time a rest station. The officer in charge of Red Cross activities was the afterward Mayor of Banbury, Mr. S. J. Mawle.

NORTH WALES EXPRESS, LONDON & NORTH WESTERN RAILWAY.

4-6-0 LOCOMOTIVE NO. 2628 "BANSHEE."

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By Steam Tram across Northern Holland.

By REGINALD H. COE.

IT has always been a matter of great regret to the writer that in this country the development of the tramway or light railway has been so backward. One has only to turn to most of the Continental countries to see the use that can be made of light railways, which are cheap to construct and maintain, and are in every respect a paying venture. Holland, for instance, provides an excellent example. The country is almost covered with a network of steam and electric light railways, which have more than justified their existence. And despite an up-to-date and very efficient railway system there are still large parts of the Netherlands which are almost entirely dependent upon the "Tramweg." Particularly is this so in the north, where the world-famous "dead cities" on the Zuyder Zee are all linked up with a marvellous system of steam tramways.

The traveller or tourist wishing to explore Northern Holland and visit districts where are to be found the only remains of the celebrated Dutch characterisation, has the choice of two routes. He may cross the Zuyder Zee from Amsterdam to Volendam by boat, or he may go by steam tram from Amsterdam. But, if he is wise, and wants to see some of the quaintest and most interesting sights in Holland, he will select the latter method.

Let us assume we are in Amsterdam and about to journey by the North Holland Tramway. The station stands a little way out of the city, but is quickly reached by ferry boat, from the deck of which views are to be obtained of the huge dockyards and harbours of Amsterdam. Our boat passes under a wide steel bridge which carries the main lines of the Dutch State and the Holland Railways.

On either side large liners can be seen belonging to the most varied nationalities, and, if we are lucky, we may pass an outward-bound "greyhound" setting forth on its long voyage to some far-distant clime. Soon, all too soon, we have reached the tramway terminus at Tolhuis, and find our little train drawn up at one of the big platforms. This "train" usually consists of two or three long saloon coaches and is hauled by a diminutive 0-4-0 tank, painted a pleasing shade of green. If there is room and it is a nice day we shall do well to take our seats at the end of the car, which is open, and from which we can enjoy the view and inhale the invigorating breezes which blow across from the Zuyder Zee.

At last we are off and pulling across the points and crossings and passing the engine and carriage sheds, rapidly gather speed. The outskirts of the town are soon left behind, and we approach a waterway, which we follow for a considerable distance. Despite its flatness, the surrounding country is most attractive. On every hand are to be seen evidences of the perseverance and skill of the Dutch. Large tracts of agricultural land, all reclaimed from the sea, are interspersed by narrow, well-kept strips of water, which in Holland do duty for hedges or walls. Dotted about over the landscape are old and picturesque windmills, while nestling amidst clusters of trees are farmsteads, whose clean and homely appearance is most inviting.

Our gallant steed has now attained a quite respectable stride, and, despite the lightness of the track, the running is most smooth, though the engine surges and rolls like a ship in distress. Then our pace slackens, and, leaving the private track on which we have been running, we enter the main street of Monnikendam. It is here that our guard must walk in front of the engine with a red flag, whilst the driver makes the echoes ring with a large brass bell which hangs from the roof of his machine. We are now passing the doors of characteristic Dutch peasant homes, and from our seats can see something of the remarkable cleanliness and comfort which have made these people so renowned. On our right we pass a large church, quite English in appearance, whilst there are several modern shops.

The town behind, the guard resumes his position in the rear, and we resume

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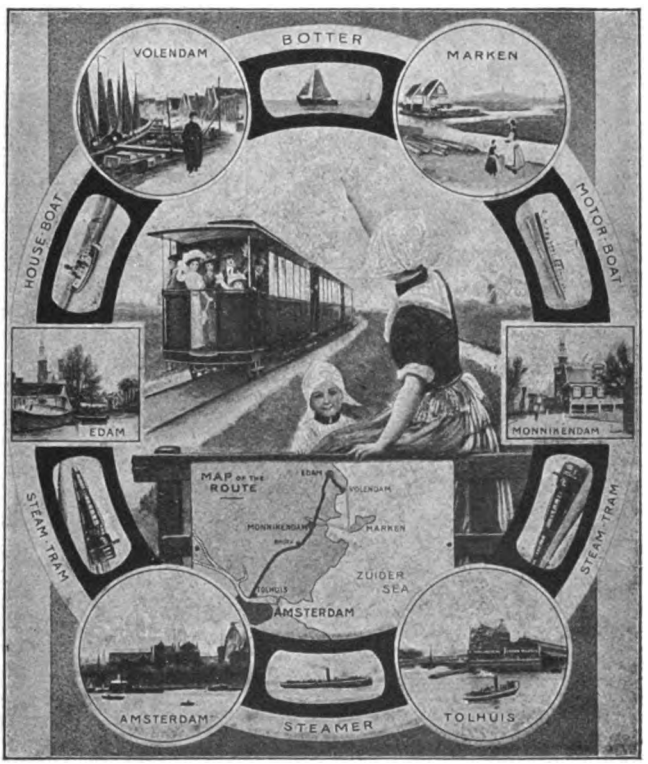
faster running till Edam is reached and connection made with the tram system of the Holland Railway Company. Edam is the terminus of the North Holland Tramway, and if we wish to continue our journey we must change. Edam is one of the most famous of the aforementioned "dead cities." At one time a prosperous seaport, it is now little more than an overgrown village. But its grass-grown streets and romantic air of decay are most fascinating, and one feels one could spend weeks in its peaceful atmosphere. A periodical cheese market is still held in the town and is attended by the peasants from miles around.



FROM AMSTERDAM TO EDAM AND VOLENDAM BY THE NORTH HOLLAND TRAMWAY.

Before resuming our journey, a few particulars respecting the tramway on which we have just travelled may not be out of place. The North Holland Tramway Company, or, to give it its correct title, the Noordhollandsche Tramweg-Maatschappij, was constructed in the late 'eighties. It possesses eleven engines, all of the 0-4-0 type, with inside cylinders and 3 ft. 6 in. wheels. They are painted green, and the machines and wheels are all encased, owing to portions of the track being laid in the public streets. The control levers, etc., are all situated in the middle, on the left hand side, where the driver sits during a run. The numbers, names and dates of construction of the locomotives are as follows :—

No.	Name.	Builders.	Date.
6.	*Parnievreud.*	Backer & Reub Breda.	1894.
7.	*De Rigu*	do.	do.
8.	*Beemster*	do.	do.
9.	*Schermerhorn*	do.	do.
10.	*Schermer*	do.	do.
11.	*Alkmaar*	do.	1895.
*12.	——	do.	do.
13.	*Zunderdorp*	do.	do.
*14.	——	do.	do.
15.	*President Steign*	do.	do.
16.	*General de Wet.*	do.	do.

* Owing to numbers 12 and 14 being under repair during my tour of the system, I was unable to ascertain their names.

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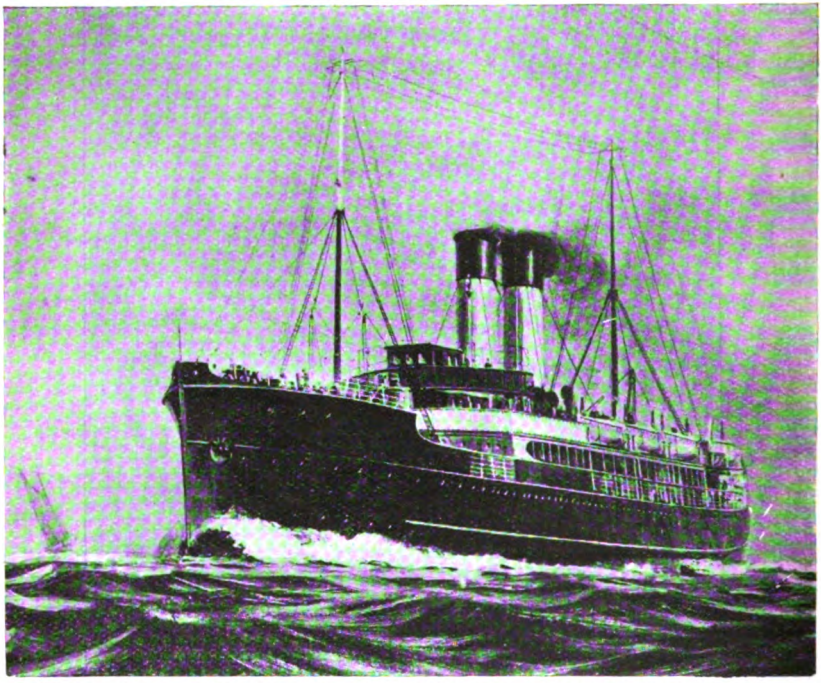
I understand Nos. 1–5, similar engines, but much older, have now been removed from service. The rolling-stock consists of 20 eight-wheeled saloons and a number of four-wheeled trucks and goods vans.

The route from Amsterdam to Edam is about 20 miles in length. From Edam to Volendam, a distance of roughly 5 miles, one travels by one of the Holland Railway Company's trams. These are very similar to those of the North Holland Company, though the engines present a slightly different appearance. There are 30 of them (all of the 0–4–0 type), and they are numbered 201–230 in the books of the Holland Company. They are considerably older than those of the other company, having all been put into service between 1882–4. These engines resemble, in appearance, the old steam tram engines which were at one time to be seen in large numbers at such centres as Birmingham, Leeds, Accrington, &c.

From Edam to Volendam the line follows a rather picturesque canal, and it is on nearing the latter place that one gets a real glimpse of the old-time Dutch dress. Volendam is a quaint old-world fishing village, perching right on the edge of the sea. Here all the residents dress as their ancestors dressed two or three hundred years ago. The men with their wide bagged trousers and gaily-coloured shirts, and the women looking more like dolls, they present a sight that one could never forget. Everyone, of course, wears clogs, though, apart from this district, the clog or "sabot" is not so frequently met with in Holland as is generally believed. Volendam is quite a small place, but one can spend hours wandering through its pretty cobbled thoroughfares, inspecting the exteriors (and perhaps the interiors) of the dolls-house looking dwellings and admiring the exquisite faces of the quaintly-dressed children. For those who would venture further afield there is a frequent service of steamboats to the Isle of Maarken, which is rich in Dutch natural character and the happy hunting ground of the artist.



G.E.R. ROYAL MAIL TURBINE STEAMER CONNECTING ENGLAND WITH HOLLAND.

To those readers of the RAILWAY MAGAZINE who are seeking somewhere fresh for their holiday, I would earnestly say, try Holland. The Great Eastern service is as perfect as it could be. One

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can leave Liverpool Street at 8.30 p.m., enjoy a splendidly-served dinner in the restaurant car or in a Pullman saloon (both being available for first and second-class passengers), sleep on the boat, and arrive at the Hook of Holland at 8 o'clock the following morning. And, once in Holland, the holiday-maker will never regret his choice, and will, I feel sure, return with one determination—to go again.

New Time-Table Cover Designs, Victorian Government Railways.

THE Victorian Railways Commissioners recently arranged to issue their public time-table for the winter train service in five sections, in a size convenient for carrying in the breast pocket, instead of one complete volume, the sections being passenger fares, goods rates, coach guide, suburban time-tables and country time-tables. Arrangements were made, through the newly created Suggestions, Inventions and Betterment Board, for the submission of an appropriate design for the front page of the last two sections. Several designs were sent in, but two alternative designs by Mr. W. H. Duffy, of the Engineer of Signals Drawing Office, were both finally accepted. The design used for the suburban lines shows the main entrance to the Flinders Street station, Melbourne, in the background and the Victorian coastline in the foreground. That for the country lines shows an express train traversing the map of Victoria, the principal railway lines being indicated. As will be noticed, the recently adopted slogan of the department, "Help us to help you," is very prominent

DESIGN FOR COUNTRY LINES SECTION.

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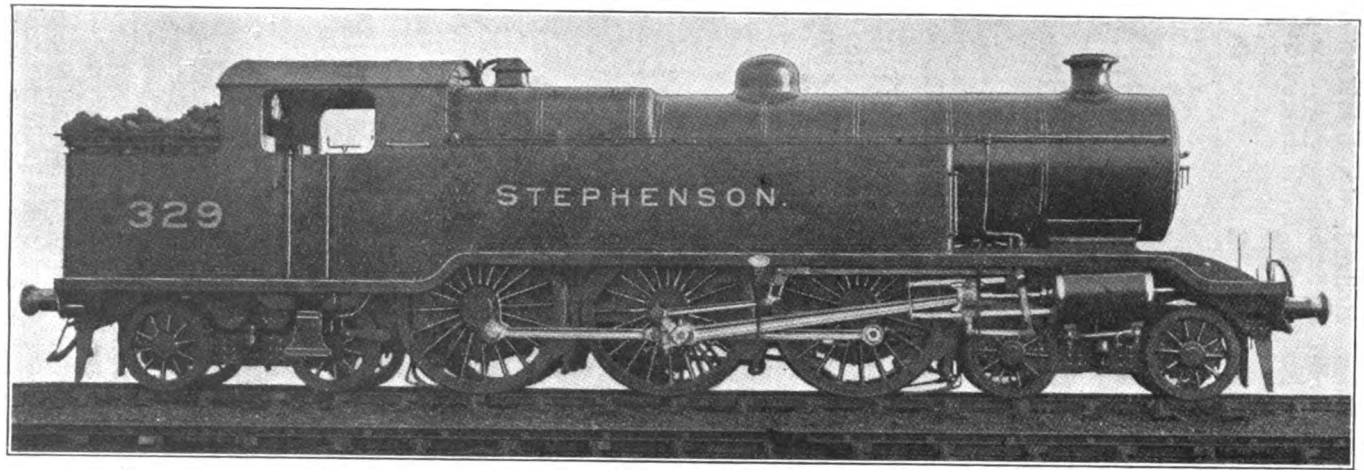
NEW 4-6-4 EXPRESS TANK ENGINE, LONDON, BRIGHTON & SOUTH COAST RAILWAY.

Lieut.-Col. L. BILLINTON, C.B.E., Locomotive Engineer.



HITHERTO only two engines of this class, No. 327, *Charles C. Macrae* and No. 328 (un-named), have been in service; but the construction of No. 329, which bears both name and number of one of the famous locomotives of the Stroudley *régimé*, is the first of several others. A few improvements are incorporated, notably the addition of 129½ sq. ft. of tube heating surface and the placing of the brake and boiler feed pumps between the frames, as in the case of the earlier engines as altered subsequently to their construction.

Cylinders	22 in. by 28 in.
Coupled wheels	6ft. 9 in. diam.
Steam pressure	170 lb. per sq. in.
Total wheelbase	40 ft.
Water capacity	2,686 galls.
Coal capacity	3½ tons.
Total weight in working order	98½ tons.

Heating surface—	
Tubes, small	1211·15 sq. ft.
Tubes, large	453·33 sq. ft.
Firebox	152·08 sq. ft.
Superheater	388 sq. ft.
Total	2204·56 sq. ft.
Grate area	26·68 sq. ft.

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Enginemen's Instruction Cars, Great Central and Great Northern of Ireland Railways.

EACH of these railways has recently equipped a car for the instruction of enginemen and for demonstrating locomotive and rolling-stock appliances. These cars are used to aid the locomotive operating staff in the examinations they are required to pass preparatory to their becoming firemen and eventually drivers. In order to give these men inside knowledge of the parts they are required to operate, detailed sections and diagrams of the various parts that go to make up the locomotive are included, which enable those concerned to obtain the necessary information about what actually happens in response to the operations they have to perform in their daily duties.

The Great Central Railway car, equipped under the direction of Mr. J. G. Robinson, C.B.E., Chief Mechanical Engineer, is 50 ft. long by 8 ft. 6 in. wide, and is open from end to end. It is carried on two four-wheeled bogies, and, being equipped with the vacuum brake, can be run on express passenger trains and sent with its contents from depôt to depôt as required. It is provided with seating accommodation for 27 persons.

Seats are arranged across the car, those next to the lecture platform being the lowest, the next seats backwards rising 2 in. above those immediately in front. The seats are made to fold up so that, when not in use, they occupy very little space. The lecture platform is arranged at one end of the car, and an adjustable lectern is provided for the lecturer's notes. Behind this is a cabinet, in which provision is made to contain 23 diagrams, which may be as large as 6 ft. 6 in. by 3 ft., together with a blackboard of the same size. These diagrams are so arranged that any one of them can be withdrawn quickly by means of a rope and balance weight for exhibition purposes, and as quickly returned to its place when finished with. A full-size diagram of the vacuum brake and fittings is visible on the end of the car when the cabinet is closed. The car is entered by side doors at the opposite end from the platform, and on the end of the car is arranged a case containing actual samples of all the lubricator trimmings used in connection with the various types of locomotives running on the Great Central Railway.

Passing along toward the platform end of the car, on the left-hand side, there is a section of a superheater header, together with a smoke tube and one of the elements. There is also a section of the combined steam blower and circulating valves and the header discharge valve. The whole of these parts can be operated exactly as is done on the locomotive itself, and the sections are so made that the operating of the steam regulator handle reproduces in the view of the person to be instructed facsimile movements to those which take place on the locomotive.

A fixed diagram illustrates in the lower part the firebox tubeplate of the locomotive, and the upper part the backplate of the firebox, and on this is arranged a boiler water gauge glass in section, showing the various fitments it contains. There are also affixed pressure steam gauges, a vacuum gauge and pyrometer dial. Further on, on the side of the car, there are diagrams showing all the valves and parts used in connection with the "Reliostop" train control apparatus, as applied in connection with the steam and vacuum brakes. No. 5 exhibit is a section of the driver's brake valves and ejectors used in connection with the vacuum brake.

Other items comprise the following :—

A diagram of the whole of the working parts of the "Westinghouse" brake.

A section of a triple oil burner as used on a number of locomotives working the Great Central Railway main line and suburban passenger trains in the London district.

A burner of the single-jet type.

A burner of the triple type, not in section.

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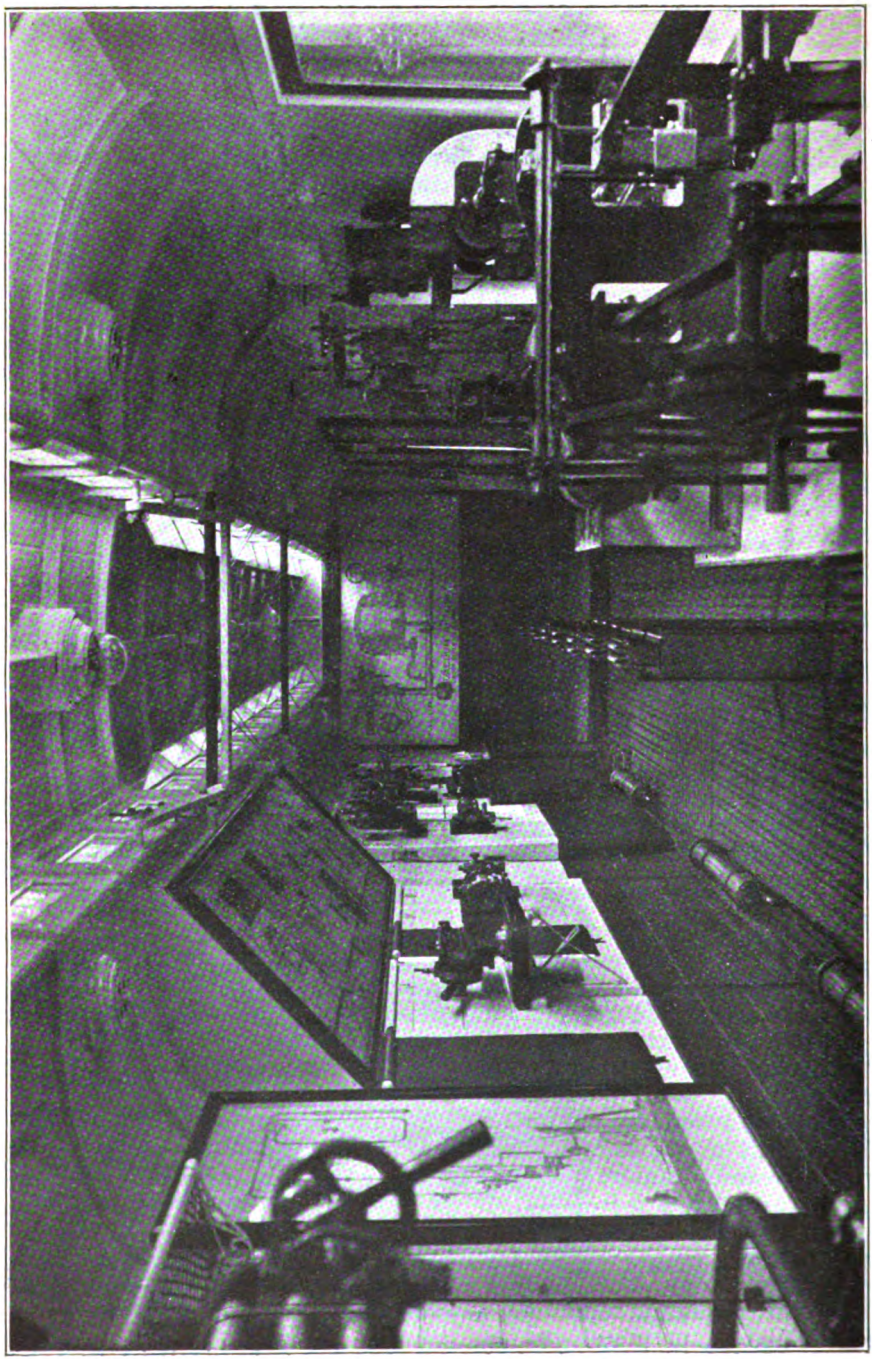

INTERIOR OF ENGINEMEN'S INSTRUCTION CAR, GREAT CENTRAL RAILWAY, LOOKING TOWARDS LECTURE PLATFORM.

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These burners may be used for burning either oil or colloidal mixtures.

A section exhibit of the "Dreadnought" ejector used in connection with the vacuum brake.

A section exhibit of the steam brake application valve used on most of the company's locomotives, controlled by the vacuum brake apparatus.

Sections of combination water injectors.

A section of the 10 mm. undertype water injector.

On the other side of the car the apparatus exhibited includes :—

"Reliostop" diagrams worked in conjunction with the automatic brake.

A section of the Furness lubricator and a section of a displacement type lubricator.

An "Intensifore" lubricator is next in order. This exhibit includes a vertical intensifier in section with four-feed distributor box and cooler and retention valve, all in section; also a horizontal intensifier complete, but not sectioned. A Wakefield mechanical lubricator in section is likewise shown.

Additional to the foregoing are a working model, half size, of the crank axle, motion, cylinders and valves of a locomotive; one half shows a Stephenson valve gear, with a direct drive on to a piston valve, giving outside steam admission to the cylinders with inside exhaust. The other side is the Stephenson link motion, operating the valve through a rocking shaft. This valve gives inside steam admission with outside exhaust. The model can be operated to show what takes place on the locomotive itself, and an interesting function of this model is to demonstrate ocularly, by the use of coloured slides, the ports that are taking steam and the ports that are exhausting steam, and the duration of the same in each case.

The above is a brief description of the chief parts contained in the car, but it will be understood that other parts will be added from time to time as occasion arises.

All the specimen parts of the locomotive which are housed round the car are readily detached from the walls and can be placed on the demonstration stand, from which point the lecturer can refer his audience to the various parts upon which he is lecturing. A stand is ingeniously arranged, with suitable fitments, to take either one specimen or another, and the stand itself can be removed entirely and housed on the side of the car on the place provided for it.

A lantern screen, lowered by the roller principle, is also provided. The lantern itself is fitted on an adjustable cross-tree, and, during the time it is being used, the car can be darkened by the use of blinds on the side windows and by closing the shutters in connection with the overhead lighting, the time taken to darken the car only occupying a few moments. The lighting can be restored just as readily.

For night illumination the car is provided with both electric and gas lighting, the electricity being generated from a dynamo operated from the wheels, working in connection with storage batteries.

The car inside is enamelled white throughout, and is provided with the usual equipment. For instance, there is a bookcase, a wash basin and storage cupboards, and it is also provided with storage heaters, which can be used for warming purposes in the winter months.

As will be gathered from the foregoing, this is a very completely equipped car of its kind, and it will doubtless prove of considerable value in connection with the purpose for which it has been provided.

The car designed by Colonel G. T. Glover, Locomotive Engineer, for the Great Northern Railway of Ireland, has been fitted up for similar use, but is somewhat differently equipped.

The arrangement of the details has been very carefully carried out, and the apparatus includes a large assortment of sectional details of locomotives and rolling-stock, viz., Stephenson's link motion with slide and piston valves, Walschaert valve gearing, the vacuum brake ejector and steam injector, Ross safety valves, Detroit sight feed lubricator, &c.

The various details are so sectioned that all the internal workings can be followed, and a small double-line model of a station with elementary signalling is provided, space in the car not permitting of anything more elaborate. One of the most interesting and instructive items in the collection is a sectional model to a scale of 1½ in. to a foot of a locomotive boiler fitted with superheating apparatus. It shows the interior in detail and is most

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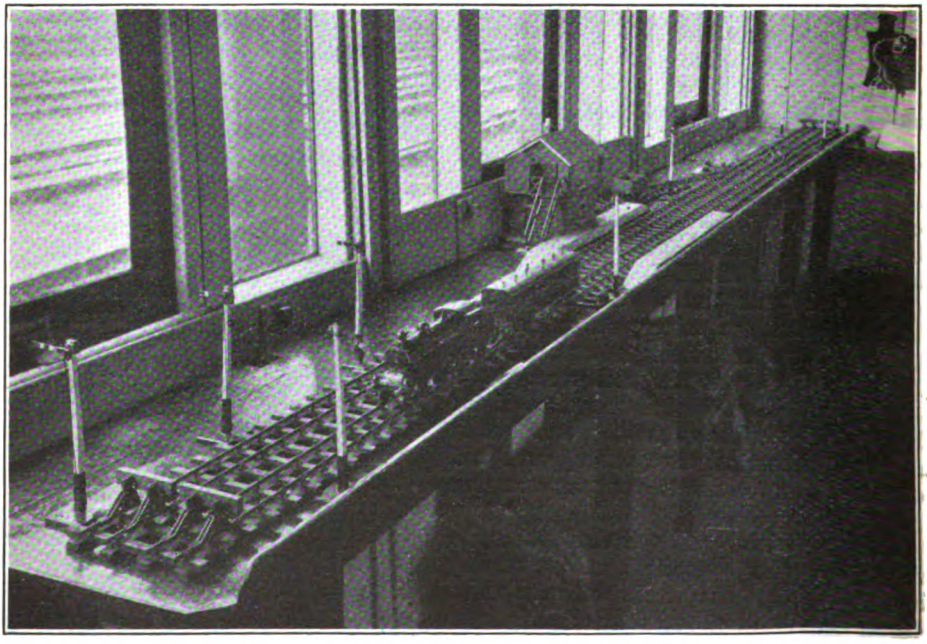
GENERAL VIEW.



SIGNALLING MODEL.

ENGINEMEN'S INSTRUCTION CAR, GREAT NORTHERN RAILWAY OF IRELAND.

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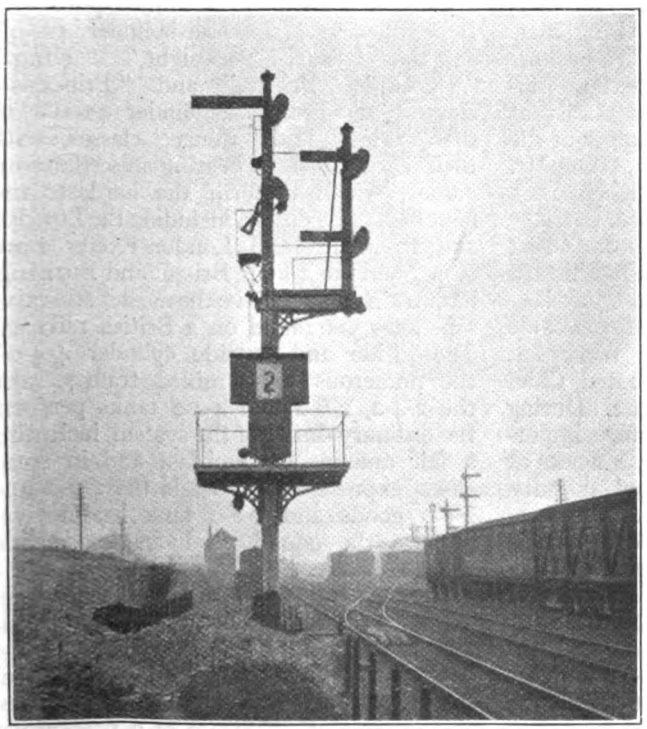
accurate and well-finished. By referring to the various "exhibits" enginemen and others can readily follow the operative principle of the mechanism in its different forms, ascertaining the details of construction and the principle on which the apparatus operates.

The present time is not one in which railways can incur much expenditure, even on such desirable objects as the education of their staffs, and, with this in view, it was considered advisable that the bulk of the material and the carriage itself should consist of second-hand stock, whilst for the same reason it was decided to employ a six-wheeled in place of a bogie coach. Electric light is fitted so that at large centres the ordinary town current of 220 volts can be used for long periods, whilst ordinary 24-volt train lighting is provided for use at the smaller centres such as Drogheda, Clones, Enniskillen and Bundoran, where only a few men are stationed and electric lighting is not installed.

As is well known, the directors and general managers of the Great Northern Railway (Ireland) have always interested themselves in the welfare of their staff, and the provision of this instruction car is further evidence in this connection. Such vehicles are part of the equipment of all large railways, notably in the Colonies and in the United States of America, the latter country, in particular, possessing very large cars, some of which are devoted to one detail of railway work alone, as, for instance, the air brake.

The mobile character of these instruction cars and the facilities they afford in the way of first-hand instruction to those who have the handling of various kinds of apparatus on the railway, combine to make this one of the most useful and beneficial methods that can possibly be devised to meet the object aimed at.

ROUTE INDICATING SIGNAL AT LOWESTOFT, GREAT EASTERN RAILWAY.



ROUTE INDICATING SIGNAL WORKING IN CONNECTION WITH CALLING-ON ARM.

AT several places on the Great Eastern Railway system, route - indicating signals have been installed, and that now illustrated, which controls entrance to Lowestoft Central station, is of interest in that the platform indicators operate either with the main home signal or, if a platform is not clear to the buffer-stops, with a calling-on arm as shown. Ordinary signals are also placed on the same bracket post. We are indebted to Mr. W. H. Bird, Signal Engineer, for the photograph reproduced.

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Mr. G. J. Churchward as a Locomotive Engineer.

IT would be invidious to suggest that Mr. G. J. Churchward, C.B.E., who retired from the position of Chief Mechanical Engineer of the Great Western Railway, is the greatest locomotive engineer in modern British practice; but it is beyond question that during the 20 years he has been chief at Swindon Great Western Railway locomotive design has been characterised by a degree of novelty and progress for which there have been few, if any, equivalents, here or abroad.

Mr. Churchward was born in 1857 at Stoke Gabriel, on the River Dart, between Dartmouth and Totnes. He was articled as a pupil to the Locomotive Superintendent of the South Devon and Cornwall Railways. In 1876 the South Devon and Cornwall lines became absorbed into the Great Western Railway system and Mr. Churchward then went to Swindon. His first appointment was in the drawing office in 1877, and subsequently he became Inspector of Materials. His next promotion was in 1882 to the position of Assistant to Mr. James Holden, then Manager of the Carriage and Wagon Works. On Mr. Holden relinquishing the position in 1885 to take up that of Locomotive Carriage and Wagon Superintendent of the Great Eastern Railway, Mr. Churchward succeeded him as Manager of the Carriage Works. After some years he became Manager of the Locomotive Works at Swindon in 1896, being promoted Chief Mechanical Engineer in May, 1902. During Mr. Churchward's period of office important extensions of the company's works at Swindon have been made, and the distinctive features of Great Western locomotive designs are attributable to him.

Towards the end of Mr. Dean's *régime* at Swindon the early stages of a new school of locomotive design were indicated by the original 4-6-0 locomotives, and the express and mixed traffic 4-4-0's and the 2-6-0 goods engines, but Mr. Churchward developed the new practice to a degree which has rendered Great Western Railway locomotives distinctive, not only in the British Isles, but all over the world. Admittedly, Great Western policy has favoured radical departure from ordinary methods, and in some respects Mr. Churchward has had unusual opportunities; but the result has been a series of notable designs which have placed the Great Western Railway in the forefront, and which daily and for many years past, have operated exceptional traffic in a remarkably efficient manner.

Our folding plate illustrates the principal classes for which Mr. Churchward has been responsible. Two, it is true, are represented only by one engine, the famous "Pacific," No. 111, *The Great Bear*, and No. 4700, the mixed traffic 2-8-0 with 5 ft. 8 in. coupled wheels, both being unique in British practice. The first of these has justified it design, though it is still the solitary representative of its type; but the latter is in course of multiplication. It is, however, the four-cylinder 4-6-0's of the "Star," "Knight," "King," "Queen," "Prince," and "Princess" classes, and the two-cylinder 4-6-0's of the "Saint" and "Court" classes, with their earlier sisters bearing miscellaneous names, which perform the hardest and fastest express duties, including the London and Plymouth and London-Exeter non-stops, and the 2-hour Bristol and Birmingham trains, which have the most distinctive schedules yet found on a British railway. The inside and outside cylinder 4-4-0's the numerous 2-6-0 mixed traffics, and the 2-4-2, 2-6-2 and 4-4-2 tanks perform the ordinary duties of the system, including a fair amount of semi-fast and in some cases express work; while the 2-6-0 and 2-8-0 goods and 2-8-0 tank locomotives operate the equally arduous goods and mineral traffic.

Among the most distinctive features of Mr. Churchward's practice are the absence of steam domes, the taper section of the boiler barrel to provide steam space just where it is most valuable, the top feed system, the use of steam at a pressure of 225 lb. per square inch, the unusual piston stroke of 30 in. used for the outside

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cylinder class, and the Swindon superheater, mostly originated under Mr. Churchward and, in some instances, interest, attention may also be directed to the rolling-stock, including restaurant cars and the 70-ft. coaches, with others,

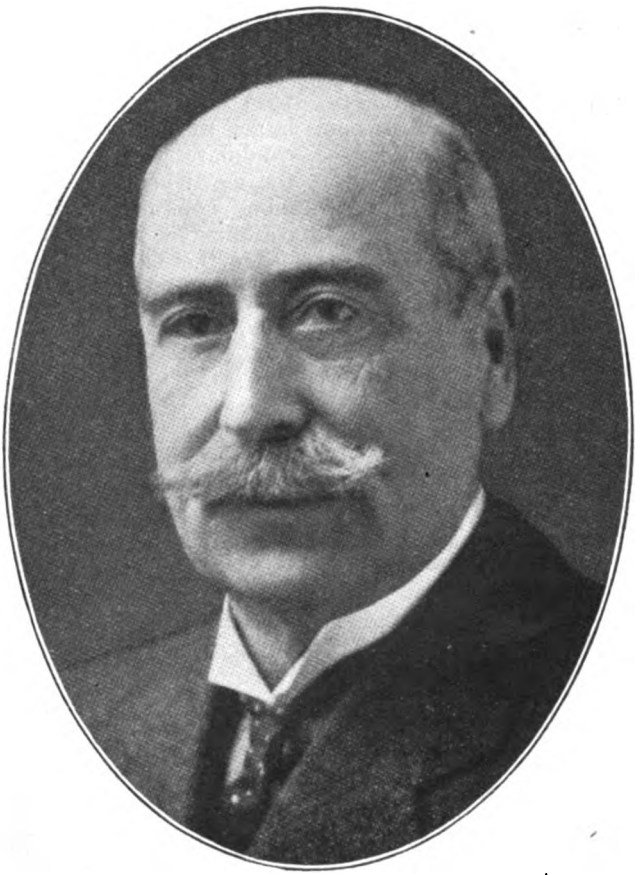

Photo.] [*Elliott & Fry.*

MR. G. JACKSON CHURCHWARD, C.B.E., M.Inst.C.E., M.I.Mech.E.,

Chief Mechanical Engineer, Great Western Railway, 1902–21.

still peculiar to Great Western practice.

Although the locomotives possess chief both passenger and goods, which are more or less distinctive. Under Mr. Churchward, too, the rail motor car or motor train has

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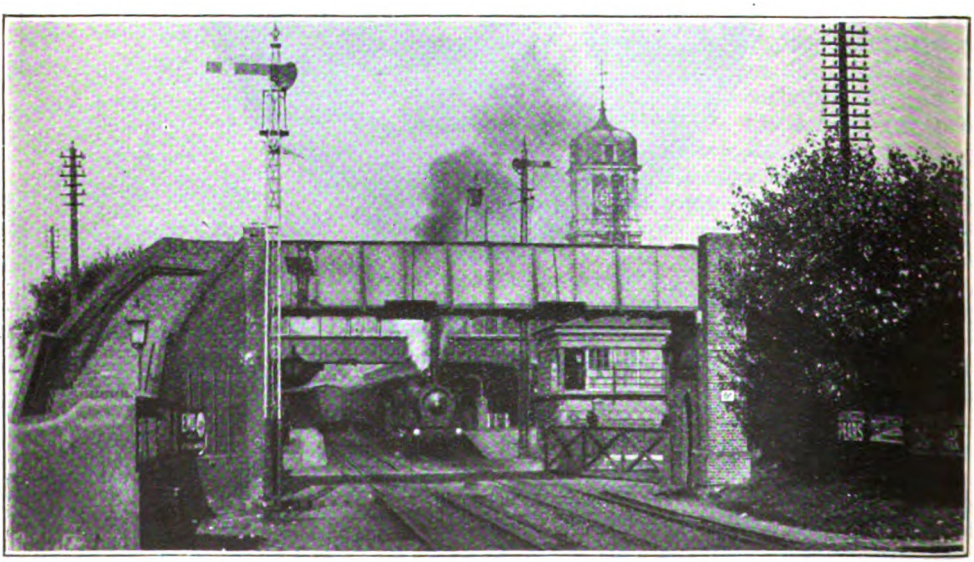
received extensive development, while his influence has also extended into the many and miscellaneous fields of work which come under the Chief Mechanical Engineer.

At Swindon itself the works have been largely extended and improved during the last twenty years, so that they now rank among the largest and most highly developed of their kind in Europe. Recently Mr. Churchward received the honour of being made the first hon. Freeman of the Borough of Swindon. This unique event in the municipal history of the town took place on October 12, and the resolution of the Town Council setting out the reasons for conferring the honour read as follows:—

"In recognition of his valuable services to the town as the first Mayor of the Borough and in other public offices; the distinguished position which he holds in the engineering profession, and the long and eminent services which he has rendered as head of the Great Western Railway Works, Swindon, having attained success in all these spheres by the conspicuous ability and dilligence at all times displayed by him."

In this connection it may be recorded that Mr. Churchward has been identified with local government in Swindon for many years past. He was elected a member of the New Swindon Urban District Council on its establishment in 1894, whilst he became Chairman of the Urban District Council in 1887, and was a member of the Water Board from its commencement. He also acted as first Chairman of the Technical Education Committee which was set up in 1898. Upon the incorporation of the town in 1900 he was elected to the Council by a larger number of votes than any other candidate. He was then elected Mayor of the newly-created borough, and by common consent filled the office with conspicuous ability. Mr. Churchward has further been identified with movements designed for the welfare of employees, and for his services to the State was in 1918 created a Commander of the Order of the British Empire.

SOUTHAMPTON WEST STATION, LONDON & SOUTH WESTERN RAILWAY.



SIGNALMAN CLOSING LEVEL CROSSING GATES PRIOR TO PULLING OFF STARTING SIGNAL FOR UP TRAIN.

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A Greater London & North Western Railway.

FROM January 1, 1922, the Lancashire & Yorkshire disappears from the list of British railways, losing its historic identity as it is merged into a new and greater London & North Western Railway. The amalgamation of these two great companies is not, however, a sacrifice on the part of either, for, as shown in the article entitled "A Great Railway Combination," published in the May, 1921, RAILWAY MAGAZINE, each of the component systems has great financial and traffic importance, and the result is a combined system, the aggregate of both, and with corresponding traffic and development possibilities. Preliminary steps were taken earlier in the year, and, procedure being facilitated by the provisions of the Railways Act, 1921, though this amalgamation is only one step towards the still greater grouping proposals of that Act, in December financial and other aspects were ratified at meetings of the shareholders of the respective companies, formal approval being declared by the Railway Amalgamation Tribunal of the Ministry of Transport on December 20.

This great combination, the most comprehensive in the history of British railways as yet, necessitates a complete reorganisation, and much interest attaches to the official appointments which came into effect on January 1, and to the operating and traffic methods and arrangements indicated thereby. The principal change is that the traffic operating and goods departments take no cognisance of the original ownership of the various lines, there being only a geographical separation into Northern and Southern Divisions. The division is made at Crewe, itself placed in the Southern Division, this obviously being the most convenient in that only one other frontier point is involved, at Whitchurch, whence to Chester is placed in the Northern Division. The engineering departments, however, with a few other sections, continue to be divided according to individual ownership, this being necessary in that, for some time at least, maintenance must agree with the respective practices of the component railways. In this connection, the London & North Western Railway, prior to amalgamation, is referred to as Division A and the Lancashire & Yorkshire Railway as Division B.

Headquarters are transferred to Euston station, and Mr. Arthur Watson, C.B.E., is assisted by Mr. H. G. Burgess (London & North Western Railway) as Principal Assistant, and by Mr. H. Marriott, C.B.E. (late Goods Manager, Lancashire & Yorkshire Railway), as Assistant for Parliamentary and other work. There are five "Assistants to the General Manager"—Mr. J. Pike, O.B.E. (Rates and Fares), Mr. T. A. Kenyon, M.B.E. (General), Mr. E. Wharton (Staff), Mr. Glynne Roberts (Indoor), and Mr. W. E. Preston (Statistical). Mr. Kenyon was Assistant to the General Manager, Lancashire & Yorkshire Railway, while Mr. Pike has held the position of Director of Rates and Charges, Ministry of Transport, prior to which he was a London & North Western Railway officer. The other assistants already occupied leading positions at Euston.

As Mr. J. Bishop, Secretary, London and North Western Railway, was due for retirement, Mr. R. C. Irwin, Secretary, Lancashire & Yorkshire Railway, becomes Secretary of the combined system, and he is assisted by Messrs. M. M. Parkes (Lancashire & Yorkshire Railway), C. Chitty (London & North Western Railway) and C. F. Graseman (London & North Western Railway), with Mr. G. Kick (London & North Western Railway) as Chief Cashier, and Mr. J. A. Redford (Lancashire & Yorkshire Railway) as Divisional Cashier, Manchester. In the Solicitor's Department, Mr. H. L. Thornhill (London & North Western Railway) becomes Solicitor, and Mr. A. de C. Parmiter (Solicitor, Lancashire & Yorkshire Railway) Solicitor for special work, with assistants from the respective staffs.

For operating purposes the Northern

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Photo.] **Mr. ARTHUR WATSON, C.B.E.,** [*Elliott & Fry.*
General Manager.
General Manager, Lancashire & Yorkshire Railway, 1919-1920, and from January 1, 1921, of both Companies.

Mr. R. C. IRWIN,
Secretary.
Secretary, Lancashire & Yorkshire Railway, 1899-1921.

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and Southern Divisions have their own chief officers, Mr. L. W. Horne, C.B.E., M.V.O., Superintendent of the Line, London & North Western Railway, being appointed Divisional General Superintendent for the Southern Division, with Mr. C. R. Byrom, O.B.E., continuing as Assistant Superintendent, though with an altered scope, while Mr. Ashton Davies, M.B.E., is Divisional General Superintendent for the Northern Division, with Mr. T. W. Royle, M.B.E., again as Assistant Superintendent. In each case there are Commercial, Staff, Freight Trains, Passenger Trains, Outdoor, Road Transport and Statistical Assistants, together with Divisional Superintendents of Police, and District Passenger, Traffic and Goods Managers. In the Northern Division there are also District Marine Superintendents and District Marine Engineers, with an Irish Traffic Manager at North Wall, Dublin. Attached respectively to the Southern and Northern Divisions, but with responsibility on the basis of original ownership, are Telegraph Assistants and Rolling-Stock Assistants for Divisions A and B; Mr. F. W. Dingley becomes an independent Superintendent of Motive Power for Division A, with Mr. W. F. Black as Assistant, Mr. F. W. Attock being Superintendent of Motive Power for Division B, under the Northern Division General Superintendent, to accord with the systems of motive power control hitherto in force, and which are not at present altered. Many of these appointments continue to be held by officers already in the corresponding positions under the old *régimé*, though some of the Northern London & North Western appointments are transferred from Euston to Manchester divisional control.

The Chief Goods Manager, Mr. S. H. Hunt, C.B.E. (London & North Western Railway) is concerned with all commercial aspects of traffic conveyed by freight trains, including conditions of contract with the public and rates to be charged. He is assisted by a Divisional Goods Manager (Southern)—Mr. W. A. Ree, London & North Western Railway; and a Divisional Goods Manager (Northern)—Mr. W. A. Marsden, O.B.E., Lancashire & Yorkshire Railway. Mr. A. T. Cotton is Mineral Assistant and Mr. A. W. Barrett, Rates Assistant to the Southern Divisional Goods Manager, while in the Northern Division Mr. G. G. Senior, O.B.E. (previously an Assistant to General Manager, Lancashire & Yorkshire Railway) is Assistant Divisional Goods Manager, Mr. B. Healey, O.B.E., Deputy Assistant Divisional Goods Manager, and Mr. J. A. Walmsley, Rates Assistant. The Chief and Divisional Goods Managers have the assistance and co-operation of the District Goods Managers and Traffic Superintendents, and of the Irish Traffic Manager.

The Civil Engineering Department is centralised at Euston, Mr. E. F. C. Trench, C.B.E., being Chief Engineer for the entire system, with Mr. R. E. S. Cooper as Assistant Engineer for New Works, Mr. A. W. Donaldson as Parliamentary Assistant, Mr. J. H. Walker, Consulting Mining Engineer, and Messrs. R. W. Owen and A. J. Briggs, Architectural Assistants. There are, however, two Divisional Engineers, concerned mainly with maintenance work, the divisions being A and B, thus agreeing with the railways hitherto concerned. Mr. W. H. Williams is Divisional Engineer, Permanent Way, for Division A, with Mr. J. T. Roberts as Assistant (Signals), and Mr. J. G. Jessop as Mining Engineer, while, for Division B, Mr. W. H. Coomber is Divisional Engineer and Mr. R. G. Berry Assistant (Signals).

In the case of the Chief Mechanical Engineer's Department, all running responsibility is transferred to the Superintendent of Motive Power under the Northern Division General Superintendent for Division B, and to the Superintendent of Motive Power in Division A. Mr. G. Hughes, C.B.E., takes the title of Chief Mechanical and Electrical Engineer, with Mr. H. E. O'Brien, D.S.O., as Electrical Engineer. There are five Divisional Mechanical Engineers—Captain H. P. M. Beames at Crewe, Mr. G. N. Shawcross at Horwich, Mr. A. R. Trevithick, C.B.E., at Wolverton, Mr. W. W. H. Warneford, O.B.E., at Earlestown, and Mr. F. E. Gobey, O.B.E., at Newton Heath. Lieut.-Colonel F. A. C. Leigh, R.E., becomes Divisional Electrical Engineer for Division A.

Mr. J. R. Ball is Land and Estate Agent, the Divisional Agents being Mr. T. Moffet (Southern), and Mr. W. Sadler (Northern). The Rating Surveyor is Mr. A. D. Lomas, F.S.I. (Lancashire & Yorkshire Railway), with Messrs. H. J. Burcham and S. W.

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Photo.] [*Lafayette.*

MR. H. MARRIOTT, C.B.E.,

Assistant to General Manager (Parliamentary).

Chief Goods Manager, Lancashire & Yorkshire Railway, 1910–21.

MR. S. H. HUNT, C.B.E.,

Chief Goods Manager.

Chief Goods Manager, London & North Western Railway, 1919–21.

MR. L. W. HORNE, M.V.O., C.B.E.,

Divisional General Superintendent (Southern).

Superintendent of the Line, London & North Western Railway, 1914–21.

MR. ASHTON DAVIES, M.B.E.,

Divisional General Superintendent (Northern).

Superintendent of the Line, Lancashire & Yorkshire Railway, 1919–21.

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MR. H. L. THORNHILL,

Solicitor.

Solicitor, London & North Western Railway, 1921.

MR. ARTHUR DE CLIFTON PARMITER,

Solicitor (Special Work).

London & North Western Railway.

MR. G. HUGHES, C.B.E.,

Chief Mechanical & Electrical Engineer.

Chief Mechanical Engineer, Lancashire & Yorkshire Railway, 1909–21.

MR. F. W. DINGLEY,

Superintendent of Motive Power, Division "A."

Chief Running Superintendent, London & North Western Railway, 1920–21.

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Beason, respectively in charge of the Southern and Northern Divisions.

The Accountant's Department is in charge of Mr. J. F. Gee (London & North Western Railway), with Mr. F. Roberts as Assistant, and Mr. Vernon Gee (Lancashire & Yorkshire Railway,) as Divisional Accountant, Manchester. Mr. F. G. Evans, C.B.E. (London & North Western Railway) is Audit Accountant, and Mr. W. Holmes, Divisional Audit Accountant, Manchester.

Mr. F. D. Stones becomes Divisional Storekeeper for Division A, and Mr. F. S. Sharp for Division B. Similarly, Mr. S. W. Burleigh is Hotels Manager for Division A and Mr. G. O'B. Hamilton for Division B. Mr. G. W. Winterbottom is Steamship Manager (East Coast).

It will be seen that, while certain changes of a drastic character were inevitable, the reorganisation has been carried out so as to obtain a fair balance between the claims of the corresponding chief officers of the two component systems, a large number of the appointments following in logical sequence. Here and there the consistency of the scheme is broken by appointments necessary for the time being, but which can be correlated with the main principles as the individualities of the component systems gradually lose their force and the new London & North Western Railway becomes a homogeneous entity. The most notable feature is, perhaps, that southern traffic control terminates at Crewe, thus reviving to some extent the conditions which obtained in early days, when the London & North Western Railway was operated very much as if the southern and northern divisions were separate systems. The wide scope of the new Northern Division is, indeed, inevitable, seeing that in so much of the area north of Crewe the London & North Western and the Lancashire & Yorkshire Railways were so closely associated that no other course was practicable. On the whole, this reorganisation appears to have been planned very fairly, while it is sufficiently systematic to indicate that modern ideas of railway operating methods are to be the rule, and there are approaches to the Midland organisation which will materially assist matters when the still greater reorganisation consequent upon the formation of the North Western, Midland and West Scottish Group has to be settled.

CROSSING THE FORTH BRIDGE.

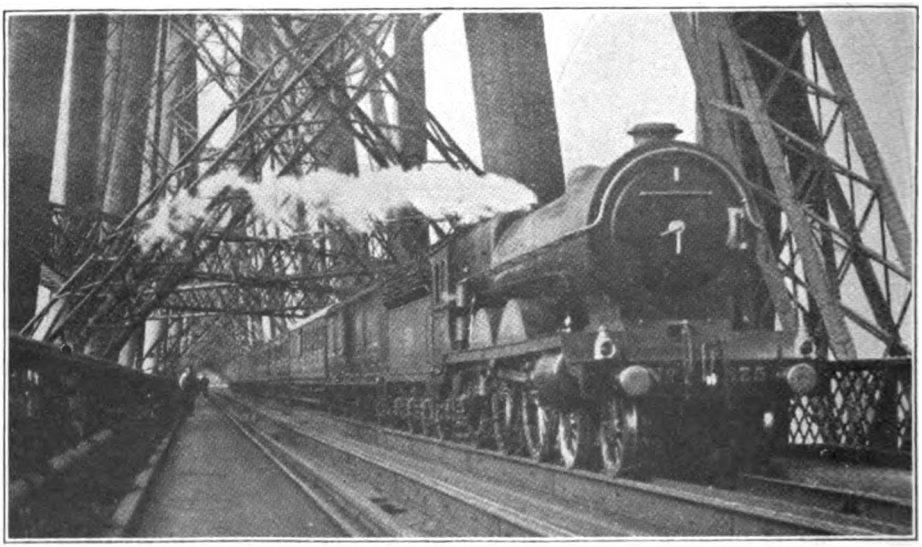

Photo.] [*Leslie J. Thompson.*

12.50 P.M. EX-ABERDEEN CROSSING THE FORTH BRIDGE.

North British Railway 4-4-2 Locomotive No. 875 "Midlothian."

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Locomotive and Train Working in the latter part of the 19th Century.

THE GREAT NORTH OF SCOTLAND RAILWAY. [No. II].

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

IT was the practice to bank the trains up the steep incline between Aberdeen and Kittybrewster, and for this purpose two four-wheeled tank engines with outside cylinders were built by Beyer, Peacock and Co. in 1856. These engines, Nos. 13 and 14, had well tanks under the boiler between the frames; the cylinders were 15 in. by 24 in., and the wheels 4 ft. 6 in. diam. These engines weighed 25 tons in working order, or 1¾ tons more than the 2-4-0 passenger engines.

The next engines to be mentioned are the 4-4-0 mixed traffic engines, Nos. 43 to 48, built by Neilson and Co. in 1865. These had coupled wheels 5 ft. 6½ in. diam. and cylinders 16 in. by 24 in. The bogies had a spherical pivot, which had a bearing in a cast-iron cup, and had a lateral traverse of 1 in. in each direction. They are interesting in that they were the earliest, or almost the earliest, bogie engines with lateral play. Their weight in working order was about 35½ tons.

It was 11 years before any addition was made to the stock, but in 1876 six very similar but larger engines, Nos. 49, 50 and 54 to 57, were built by Neilson and Co. These also had 5 ft. 6½ in. wheels, but the cylinders were 17 in. by 24 in.

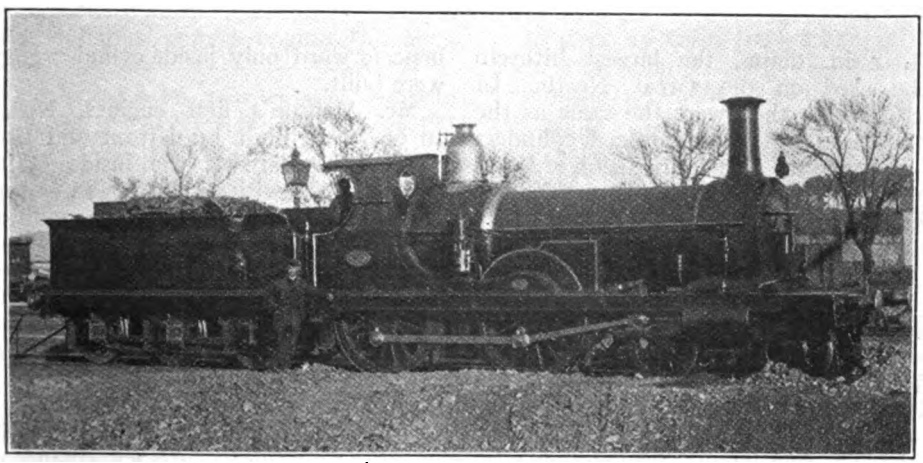

Photo.] 4-4-0 LOCOMOTIVE, No. 58. [*Loco. Publishing Co., Ltd.*

Designed by Mr. W. Cowan and built by Neilson & Co., 1878.
Coupled wheels, 5 ft. 7 in. diam. Cylinders, 17½ in. by 26 in.

They were almost the same in outward appearance, as No. 58, illustrated. This engine, however, belonged to the next series, which consisted of Nos. 51 to 53 and 58 to 62. These had 5 ft. 7 in. coupled wheels, and cylinders 17½ in. by 26 in., and were built by Neilson and Co. in 1878. They had 150 lb. pressure.

The last lot of engines of Mr. Cowan's design were Nos. 1, 2 and 3, built by Neilson and Co. in 1879. They were passenger engines, with coupled wheels

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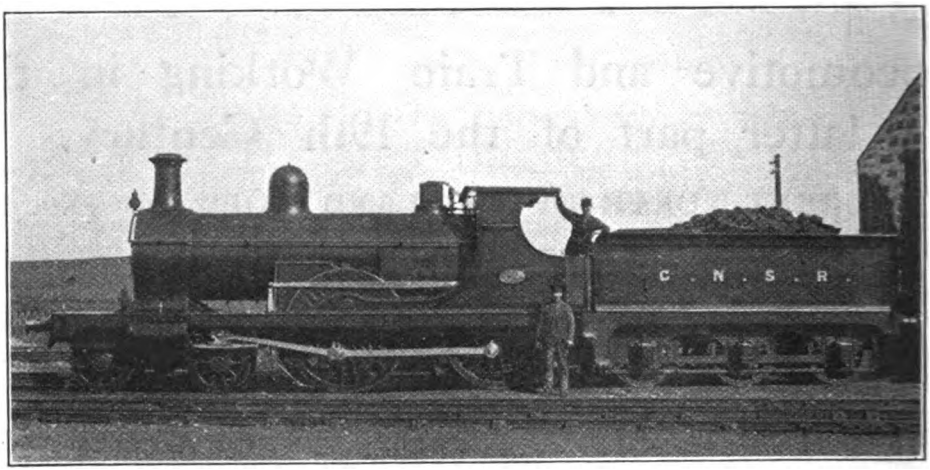

Photo.] **4-4-0 LOCOMOTIVE, No. 3 (Series 1-3).** [*Loco. Publishing Co., Ltd.*

Built by Neilson & Co., 1879, and subsequently rebuilt with new boiler.
Coupled wheels, 6 ft. 1 in. diam. Cylinders, 17½ in. by 26 in.

6 ft. 1 in. diam., the largest hitherto to be used on the Great North. In other respects they were the same as the "51" Class, with the same sized cylinders 17½ in. by 26 in. The illustration of No. 3 shows this engine as rebuilt with a new boiler. The bogies were of a more modern pattern with bogie "pins," and flat bearing plates. The engines had a total heating surface of 1,107½ sq. ft. and weighed 39½ tons in working order. With these 62 engines ends the first period of locomotive development on the Great North. All engines were direct derivatives of D. K. Clark's early engines, and all had outside cylinders. They were probably much too good for the train service as it then was.

The years 1881-83 mark the first signs of improvement in the general services of the Great North. They were small, it is true, but then Mr. Moffat, the new General Manager, and Mr. A. C. Reid the Passenger Superintendent, who carried out Mr. Moffats ideas in a very able manner, could not be expected to do everything at once. But from this time the improvements were continuous. And from the same period Mr. James Manson, afterwards of the Glasgow and South Western Railway, took charge of the locomotive department, in which a new era was also inaugurated. The designs with outside cylinders disappeared, and henceforward only inside cylinder engines were built.

Mr. Manson's first engines, Nos. 63 to 68, were built by Kitson and Co. in 1884. They are of the inside cylinder 4-4-0 type, with 6 ft. 0½ in. coupled wheels and 17½ in. by 26 in. cylinders. The old type of boiler with raised fire-box surmounted by an ornamental dome, disappeared, and the more modern type with flush fire-box, round-topped dome on the middle of the barrel, and Ramsbottom safety valves, replaced it. The new chimneys were almost exactly like those used by Mr. P. Stirling on the Great Northern Railway. The new engines were not of particularly large size; the boiler had a total heating surface of only 1,036 sq. ft., towards which the fire-box contributed 90 sq. ft.

In 1885 three very similar engines, Nos. 69 to 71, but with 5 ft. 6 in. coupled wheels, were also built by Kitson and Co. for mixed traffic work. These also had 17½ in. by 26 in. cylinders. In 1887 two more of the same class, Nos. 5 and 6, were built by Mr. Manson at the company's own works at Kittybrewster, and were the first engines to be constructed by the Great North of Scotland Railway.

A third and larger class of 4-4-0 express engines was built by Kitson and Co. in 1888. There were nine of these, Nos. 4, 7, 9, 10, 17, 18 and 72 to 74.

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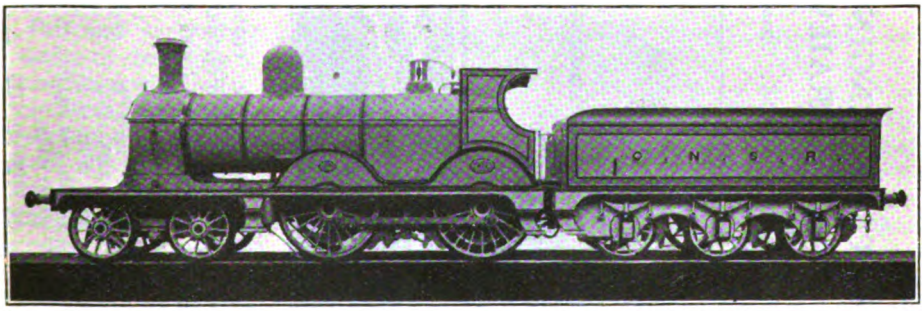
These were specially intended for the fastest trains between Aberdeen and Elgin via the coast line, which had been opened only in May, 1886. The cylinders are 18 in. by 26 in., the coupled wheels 6 ft. 0½ in. diam. and the bogie wheels have the large diameter of 3 ft. 9½ in. The heating surface of the tubes was 1,094 sq. ft., of the firebox 106 sq. ft., total 1,200 sq. ft. There were several features of special interest in these engines. The bogies were of the swing link type, with double pins, and were, I believe, almost the first engines in Great Britain to have swing link bogies, except Mr. McDonnell's North Eastern engines of 1884. The slide valves were placed horizontally on the tops of the cylinders, and driven by rocking shafts in the manner so often seen of late years. This was one of the earliest examples in this country of the application of the modern form of rocking shafts to inside cylinder express engines,* though Mr. P. Stirling had used rocking shafts for six heavy coal engines as far back as 1872, but these had the valves underneath the cylinders. Moreover the valves of Mr. Manson's Great North engines were balanced by means of a circular ring on the back, held up against the cover by springs.

It is also worthy of note that Mr. Manson retained the D. K. Clark air inlets in the fire-box, but in a modified form, and therefore no brick arch was used. The air inlets were 3 in. diam., and placed in the front and back instead of the sides, but the steam nozzles were discarded, as it was found that the blower was quite efficient in maintaining the air currents when steam was shut off. The new engines were comparatively light for their power, and weighed only 41½ tons in working order. According to *Engineering*, they had on certain occasions, on the 10.10 a.m. up train from Elgin to Aberdeen, run from Huntly to Aberdeen, a distance of 40¾ miles, in 42 min.

(To be continued).

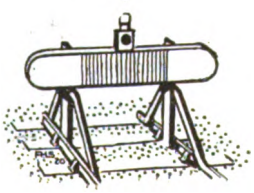
* G.W.R. engine No. 9, as originally constructed in 1881 had rocking shafts, but the eccentrics were outside.



Published by kind permission of] [*Messrs. Kitson & Co.*

4-4-0 LOCOMOTIVE, No. 72.

Designed by Mr. J. Manson, and built by Kitson & Co., Ltd., 1888.
Coupled wheels, 6 ft. 1 in. diam. Cylinders, 18 in. by 26 in.



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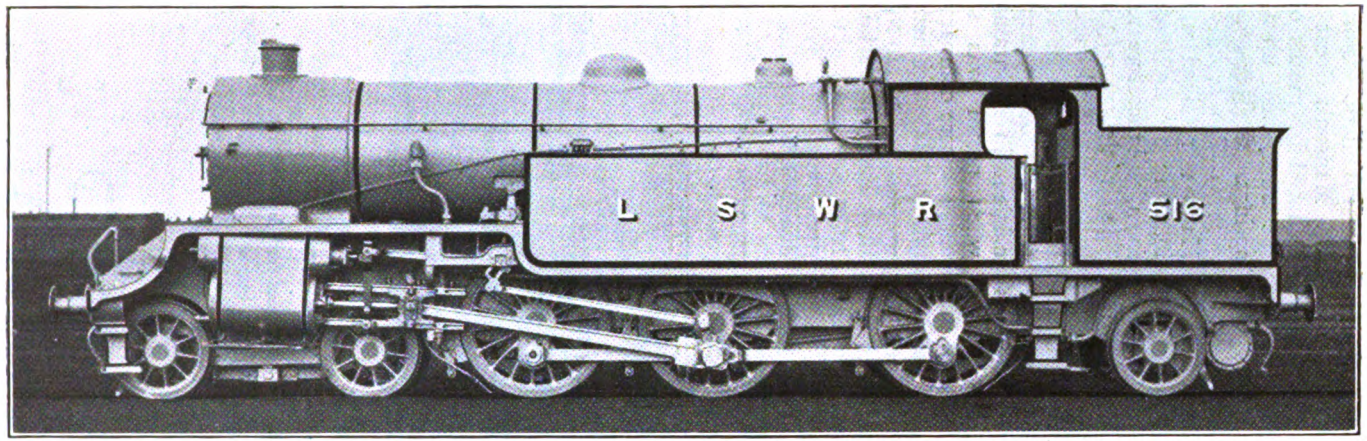
4-6-2 SUPERHEATER TANK ENGINE, LONDON & SOUTH WESTERN RAILWAY.

Mr. R. W. URIE, Chief Mechanical Engineer.



IN the August, 1921, RAILWAY MAGAZINE, the corresponding 4-8-0 class was described, particulars of both designs having previously been given in the February, 1921, number. The first of the 4-6-2 engines is now illustrated above, the class being intended for local goods service to and from the new concentration yard at Feltham.

Cylinders	21 in. by 28 in.
Coupled wheels	5 ft. 7 in.
Total wheelbase	36 ft. 6 in.
Steam pressure	180 lb. per sq. in.
Water capacity	2,000 galls.
Coal capacity	3½ tons.
Total weight in working order	96 tons 8 cwt.

Heating surface—	
Large tubes	357 sq. ft.
Small tubes	910 sq. ft.
Firebox	139 sq. ft.
Superheater	231 sq. ft.
Total	1636 sq. ft.
Grate area	27 sq. ft.

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British Locomotive Practice and Performance.

By CECIL J. ALLEN, A.M.Inst.T., A.I.Loco.E.

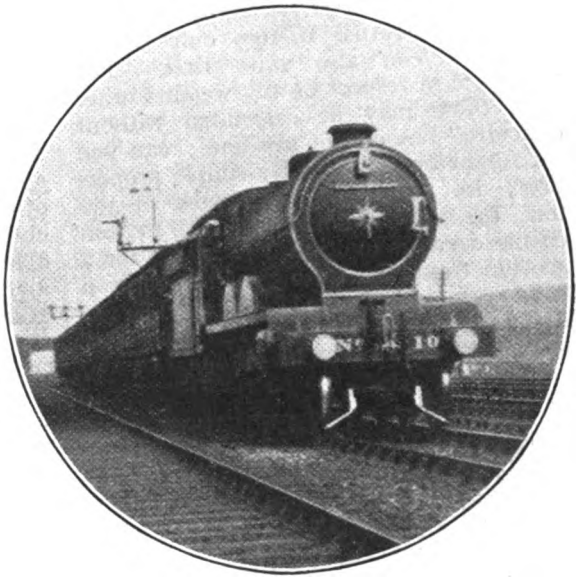

Photo.] [*R. R. Baker.*

NORTH BRITISH RAILWAY.
Edinburgh-Perth Express.
4-4-2 locomotive, No. 510, "The Lord Provost."

IN this and succeeding issues it is my desire to deal with a mass of correspondence which has accumulated in connection with the subject matter of these articles during recent months.

First of all, the writer of the original letter upon which I based my October article, relative to the method of ascertaining locomotive horse-power from a consideration of the work performed on rising grades, sends a note as to a point in which I did not make myself quite clear. In the last line of the right-hand column, at the bottom of page 249, "or 2·98" obviously means miles per hour multiplied by 2·98; that is to say, 2·98 represents the working out of the constant figures given in the equation immediately preceding.

Another friend writes in regard to the same article, "I suppose we cannot look upon the same method as capable of extension to deal with bad weather conditions—a strong side-wind, for example—and so, in fairness to the locomotive concerned, we ought to exclude any run not made under normal weather conditions from our calculations." That is so. It would never be possible to take mathematically into account anything so capricious as a wind, whose effect on the running varies every moment, according to whether the train is sheltered in a cutting or exposed on a bank, or according to the angle at which the wind catches the coaches—another factor varying in accordance with every curve traversed in the line. Such a method as this of arriving at horse-power is clearly approximate, at the best of times, while the slightest abnormality of weather conditions may produce results falling considerably short of the locomotive's real output of tractive power.

A correspondent in Nigeria, excusing his request with the plea that the RAILWAY MAGAZINE is designed for "all who travel by train," and not for "engineers only," as a non-technical reader, asks for a little further enlightenment on the formulæ given in the article in question. "I read the diagram on page 250 as stating," he writes, "that the horse-power required to overcome frictional resistance at, say, 20 m.p.h., is 65 for a locomotive and tender of 100 tons, or 32 for a 100-ton train, and presumably 97 for the two together. Why does the 100 tons of train want only half the horse-power of 100 tons of machinery?" Obviously, because of the increased

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resistance offered by the reciprocating motion of the latter, as compared with the simple journal friction only of the former. "You also state that, 'The resistance in respect of any weights other than these may be calculated without difficulty,' but do not say how; can you shed light on this?" By simple proportion; for an engine and tender of 150 tons, the result obtained with the 100-ton engine curve is multiplied by 1·5; for a 400-ton train, the reading of the 100-ton train curve is multiplied by 4; and so on. And lastly, "In regard to resistance due to gravity, are the results obtained by the gravity formula to be *added* to those obtained from the resistance curves?" Certainly. "If so, how is the figure of 1,160 reached in your November article, page 324?" Thus: train = 305 tons; locomotive and tender (allowing for consumption of fuel and water) = 125 tons; total 430 tons. Resistance due to gravity $= 5{\cdot}97 \times \frac{27{\cdot}3 \text{ (m.p.h.)}}{80 \text{ (gradient)}} \times 430 = 876$ h.p. Resistance due to motion of an engine and tender of 100 tons (from engine curve) at 27·3 m.p.h. = 105 h.p.; proportionately for one of 125 tons, the figure is 132 h.p. Similarly, a train of 305 tons at the same speed requires 50 (from train curve) × 3·05 = 152 h.p. 876 *plus* 132 *plus* 152 = 1,160. I trust this is quite clear.

Another letter on the same subject comes from a reader in Cheshire, who says, "It occurs to me that it would be extremely interesting, and would throw a good deal of light on the accuracy or otherwise of these curves, if the results so obtained could be compared with those observed in some official test runs with a dynamometer car. For example, a 'Claughton' was tested shortly before the war, between Euston and Crewe, and again between Crewe and Carlisle. I have not a record of the figures by me, but it would be very interesting to compare them with the results obtained by the method you describe in the case of running, say, up to Tring or up to Shap Summit. If I remember rightly, the maximum indicated horse-power recorded on these trips was about 1,620, but I do not remember where this occurred." I have not the leisure at the moment to turn up the records referred to in this letter, and work out the figures; I might mention, however, that in my own classic trip behind *Sir Gilbert Claughton*, when with a 310-ton train we *attained* 48·4 m.p.h. on the 1 in

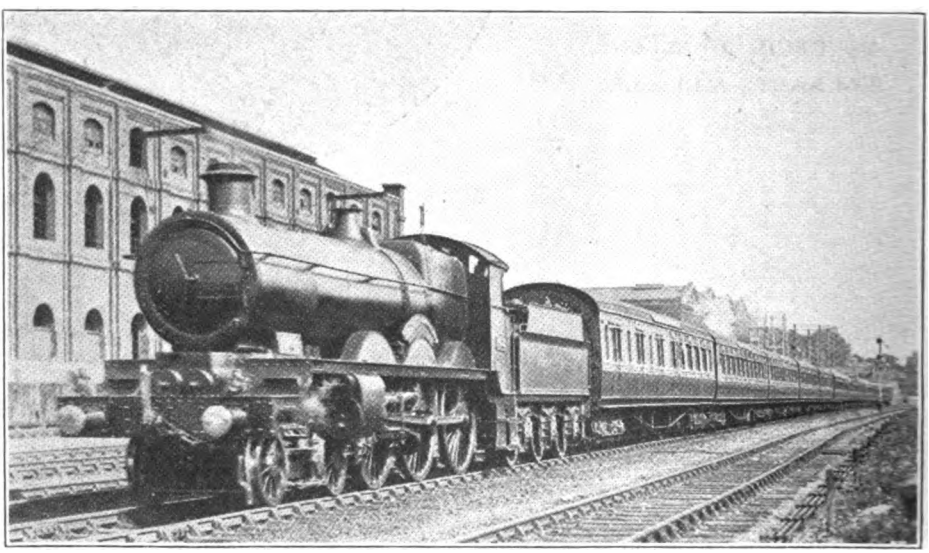

Photo.] GREAT WESTERN RAILWAY. [*F. E. Mackay.*

Down Birmingham and North express. Four-cylinder 4-6-0 locomotive, No. 4058, "Princess Augusta."

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133 portion of Grayrigg bank from a dead start at Oxenholme, the horse-power by the same method of calculation works out at 1,718.

"It should, I think, be borne in mind," my friend adds, "that if the rolling-stock were in better running condition on one run than on another, your correspondent's method would be likely to show a figure relatively too high in the case of the better rolling-stock as compared with the other. The effect of wind on the figures"—this has already been mentioned—"is also quite obvious. It is for reasons such as this that absolute accuracy can never be guaranteed." This is so true as to need little emphasis. So variable are the conditions attaching to train resistance that Sir John Aspinall, in his paper on the subject read before the Institution of Civil Engineers in 1902—probably the most complete of its kind ever compiled—cited no less than *fifty-five* formulæ, evolved by different authorities as the result of experiment, by which atmospheric and other resistances to train motion may be arrived at!

Another correspondent has been somewhat puzzled by the disparity of the results tabled in the October article behind different types of engine, which do not seem to accord with an estimate of their probable power based on dimensions. The answer to this difficulty is clearly that the results recorded are merely those of random observations. There is no guarantee at all in any specific case that the engine or engines concerned were being worked at their full capacity, and this is a matter in which the driving "tradition" of different lines may be expected to have an important influence. The figures are set down merely for any interest that they may have. The writer next inquires whether the 4-6-0 London and South Western engines of the "736" class would develop a higher horse-power than the figure cited in my November article, if worked at a later cut-off than was the case on those occasions on which I was a passenger on the footplate. Undoubtedly, yes; I was at pains to draw attention to the high horse-power figure attained despite the easy conditions under which No. 743 was working.

Referring to my table of 55 m.p.h. runs in the December issue, a reader points out that the Great Western down Newspaper express from Paddington at 2.30 a.m. is booked to run to Swindon in 83 min., the average speed for 77·3 miles working out at 55·9 m.p.h. This run should have

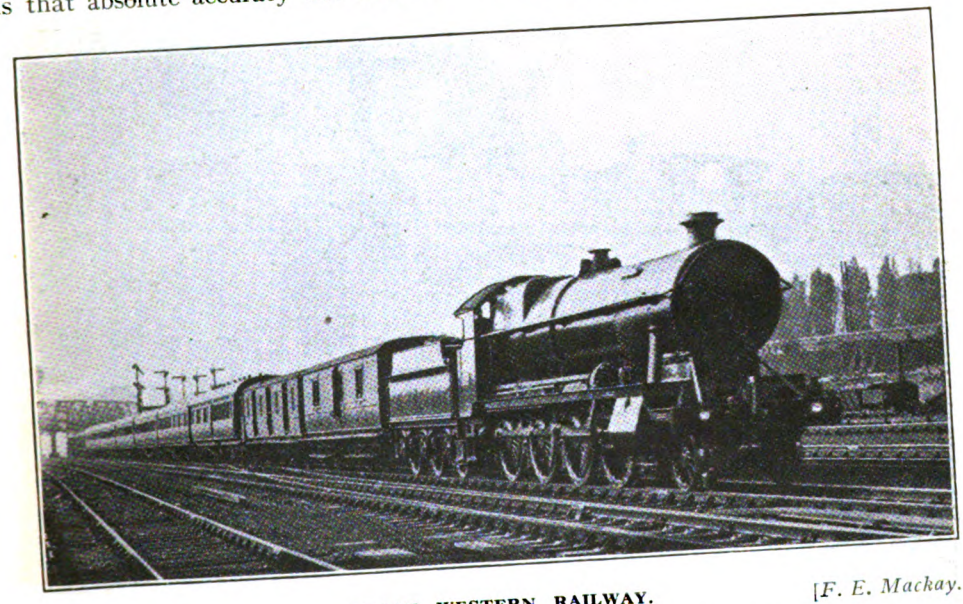

Photo.] GREAT WESTERN RAILWAY. [*F. E. Mackay.*

Up Bristol express. 2-8-0 mixed traffic locomotive, No. 4700.

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been included in the table. But the other train he mentions—the 8.50 p.m. from Swindon to Reading—has a *working* time of 46 min. in place of the public time of 45 min., for the 41·2 miles, and therefore falls outside the pale. A Cornwall reader also complains of my exclusion from the table of the London–Birmingham two-hour trains making intermediate stops. But they are not excluded at all, as all the intermediate runs that they make are duly tabulated, but their overall two-hour timings, which, of course, I readily agree are much harder to work than the non-stop two-hour trips, are omitted from the totals simply to avoid counting the same run of the same train twice over. Another correspondent draws attention to an unfortunate error in my profile of the route between Salisbury and Exeter, given in the November article, which greatly underrates the severity of Sherborne bank; the three strips in succession from mile-post 116 reading "150," "250," and "100," should be altered to "80," "100," and "165" respectively—a very much harder proposition for up trains than that shown.

Turning now to locomotive performance on the restored two-hour timings between London and Birmingham, I wish first to make a detailed comparison of the topography of the two routes. In order that this comparison may be followed closely, I have prepared a profile of both to the same scale; the Rugby-Birmingham section of the London and North Western route has never previously been reproduced in the RAILWAY MAGAZINE, nor have the two main divisions of the Great Western route — London-Aynho and Aynho-Birmingham—appeared before as a continuous profile to the same scale. The first point of note is the extraordinary general similarity of the contours. Summits on the North Western line at Tring, Roade, Welton and Berkswell are faithfully reproduced on the Great Western near Saunderton, Ardley, Fenny Compton and Hatton, with no greater variation in location than four miles in the distance from London, while both lines finish with a sharp rise at the Birmingham end. Even the minute London and North Western "summit" at mile-post 49¾ appears on a much enlarged scale on the Great Western

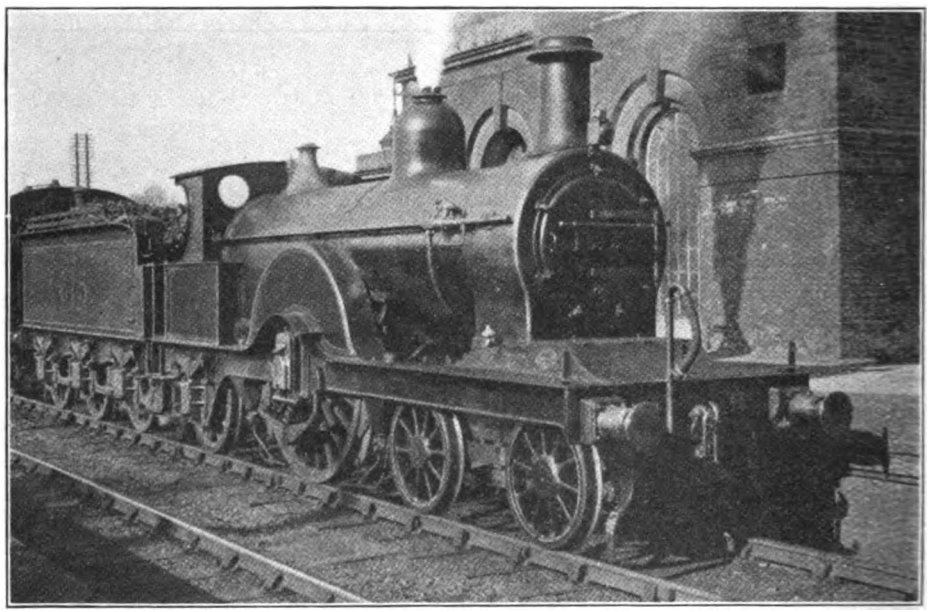

Photo.] MIDLAND RAILWAY. [*F. H. Stingemore.*

One of the last of the Johnson singles. No. 615 (now withdrawn from service), on stopping train at Radlett.

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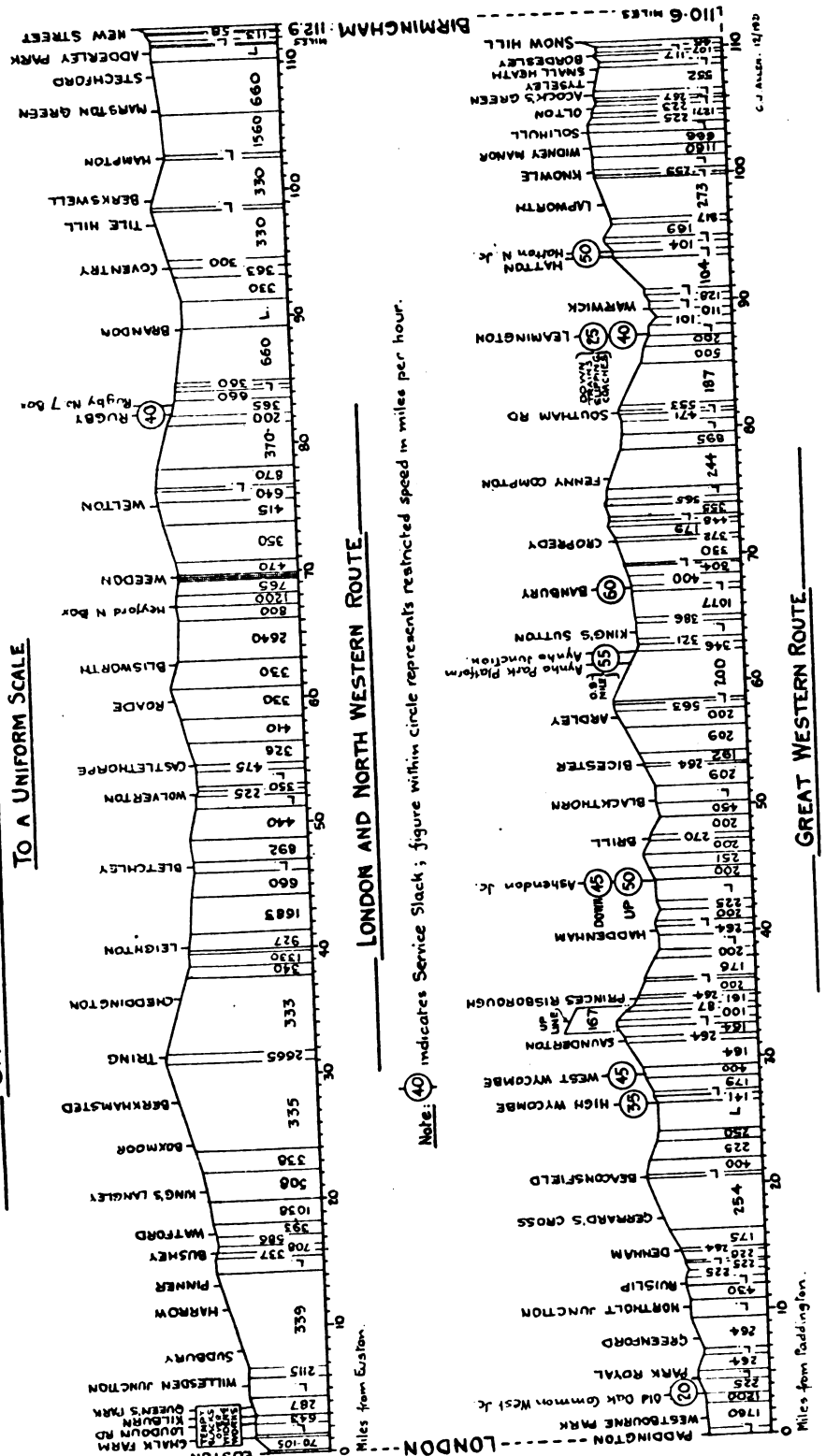

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Railway at mile-post 46¼. And yet perhaps this likeness is not altogether surprising, as the two routes never quite reach a maximum of 20 miles apart—Ardley Tunnel to Wolverton, the greatest distance, is about 19½ miles—and the same physical features of the country traversed affect both.

But a closer comparison of the two profiles reveals the fact, without a possibility of controversy, that the Great Western is by far the harder route of the two. A casual glance is sufficient to show how the Great Western profile resembles an exaggerated version of the North Western, with all the easily-flowing grades of the latter sharpened into comparatively steep banks. Expressing the comparison in figures, we have the following result :—

Grade.	L. & N.W. Route. Miles.	Per cent.	G.W. Route. Miles.	Per cent.
1 in 117 or steeper ..	2·1	1·9	5·7	5·2
1 in 225 or steeper ..	3·2	2·8	13·0	38·8
1 in 350 or steeper ..	47·7	42·2	63·5	56·2
Flatter than 1 in 350 ..	65·2	57·8	45·1	40·8

The most notable contrast, as will be seen, is in respect of grades of 1 in 225 or steeper, which compose well over one-third of the Great Western route, as against not much more than one-fortieth of the North Western. A consideration of individual banks brings us to the same conclusion. In this case I have calculated from the profiles the "vertical rise" (total height through which the train is "lifted," independent of intermediate falling gradients), as the truest measure of the uphill work to be performed :—

LONDON AND NORTH WESTERN DOWN JOURNEY.

—	Between Mile-posts.	Total Length.	Vertical Rise. Total feet.	Vertical Rise. Ft. per mile.	Average Gradient, 1 in—
		Miles.			
Euston-Tring	0 –31	31	384	12·4	426
Castlethorpe-Roade	54 – 60¾	6¾	101	15·0	352
Weedon-Kilsby	69¾ – 76½	6¾	85	12·6	419
Brandon-Berkswell	91½ – 98½	7¼	113	15·6	338
Hampton-New Street ..	103 –113	10	85	8·5	621

GREAT WESTERN DOWN JOURNEY.

—	Between Mile-posts.	Total Length.	Vertical Rise. Total feet.	Vertical Rise. Ft. per mile.	Average Gradient. 1 in—
		Miles.			
Paddington-Saunderton ..	0 – 33	33	421	12·8	413
Blackthorn-Ardley	51¾ – 58¾	6¾	156	23·1	229
Banbury-Cropredy	67½ – 74	6½	95	14·6	362
Warwick-Hatton	88¾ – 94½	5¾	205	35·7	148
Lapworth-Snow Hill ..	96½ – 110½	14	149	10·6	498

In the case of every single well-defined ascent, therefore, the Great Western route easily leads the North Western in the matter of steepness. When we come to total vertical rise from London to Birmingham, which incorporates various short grades not included in above figures, the Great Western aggregate works out at 1,137 ft., or 10·3 ft. per mile, as against the North Western figure of 792 ft., or 7·0 ft. per mile, the former, on this basis, being 47 per cent. steeper than the latter—nearly half as much again. Against this disparity, the only advantage which can be claimed by the Great Western is a route 2·3 miles the shorter of the two;

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the actual distances are 110 miles, 47 chains from Paddington to Snow Hill, and 112 miles, 71 chains from Euston to New Street.

When we come to service slacks, the Great Western is in a still more unfavourable position. Against the one North Western check at Rugby (coupled, for the time being, with the reduced speed imperative over the widening works between Camden and Queen's Park), the Great Western permanent "cautions" number eight in all. Even if we grant that the slacks at Hatton North Junction and Banbury are virtually "paper" slacks only, speed in general being so little in advance of these figures as rarely, if ever, to be reduced, we still have six cautions left, two of which—High Wycombe and Leamington—are exceedingly severe, occur at points where speed would otherwise rule high in both directions, and are almost invariably carefully observed. West Wycombe is more or less "covered" by High Wycombe, two miles away, and at Ashendon Junction, which is very well laid out for both roads, the somewhat unduly severe restriction gives place to a general average of about a mile-a-minute, although even this involves loss of time, as high speeds would normally rule here also. Old Oak Common check does not involve the loss of time it might, being so comparatively near the terminus; Aynho Junction slack spoils a fast run down the bank, as well as the "rush" up to Ardley Tunnel from the easy grades beyond Banbury.

Altogether, therefore, it would hardly be wide of the mark to say that the service slacks between Paddington and Birmingham, on a non-stop journey with a medium load, are worth, at a lowest estimate, 8 min. as compared with the time taken on an unchecked run. On the rival route the Rugby slack, if closely adhered to, is worth 1½ min. on the down journey to 2 min. on the up, and engines of down trains have the disadvantage of starting "cold" up the ascent to Camden, which begins at the Euston platform end—a more serious handicap in the case of superheater than non-superheater locomotives. It is difficult to allow anything in respect of this difficulty, however, as, if we deduct the ascent to Camden, the North Western down route becomes still easier by the reduction of the total vertical rise from 792 to 730 ft. Allowing the North Western 1½ to 2 min. for Rugby, and, say, 2½ min. for the extra 2·3 miles as compared with the Great Western route, comparing non-stop journeys with each other, the Great Western is the harder of the two by fully 3½ to 4 min., apart entirely from the question of the harder Great Western Railway gradients.

Further, to pile "Pelion upon Ossa," out of six Great Western two-hour trains, only two are actually non-stop, the remaining four having a running allowance of 117 min., with 3 min. standing at Leamington; a seventh train (the 6 p.m. up) contrives in an overall time of 122 min. to make two stops, with an actual running time of 118 min.; and three more expresses make double stops inside an overall allowance of 125 min., and a running time of 120 min. If allowance be made for the time lost in slowing down to and restarting from these stops, the work required of the engines on the trains making stops must be equivalent to a non-stop booking of 115 to 113 min. in the case of eight Great Western trains. Deduct the service slacks also (with due allowance for the fact that in most cases stops coincide in their location with service speed restrictions), and as a net result it is apparent that the average running speed of the Great Western service is something over, rather than under, a mile-a-minute. Against this the London and North Western Railway, with the easier road, many fewer service slacks, and, on the average, no heavier loads, musters only two up trains which make the two-hour run with a 2 min. intermediate stop, at Coventry, and a third which now calls at Willesden while maintaining the two-hour overall limit; these expresses are limited to maximum coach loads of 200 tons. It is impossible to dispute the clear evidence of scientific fact, and on this evidence principal honours, from the locomotive point of view, must go to the Great Western Railway in regard to the London-Birmingham two-hour services. At the same time, the fact that, proportionately to this disparity, the London and North Western engines have appreciably more "time in hand" on the two-hour schedules than those of the rival route, which have next to none, leads to somewhat better average punctuality on the

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GREAT WESTERN RAILWAY. LONDON-BIRMINGHAM.

2979 *Quentin Durward* 2-cyl. 4-6-0.	4027 *King Henry* 4-cyl. 4-6-0.	4024 *King James*	Down.	Engine Number : Engine Name : Engine Type :	Up.	2952 *Twineham Court.* 2-cyl. 4-6-0.	4007 *Rising Star.* 4-cyl. 4-6-0.	3821 *County of Bedford.* 4-4-0.
Tons 175/185 ,, 142/150 ,, 142/150	Tons 276/295 ,, 250/265 ,, 222/235	239/255 206/220 179/190		Load : Paddington-Risborough : Tare/Gross Load : Risborough-Banbury : ,, Load : Banbury-Birmingham : ,,		Tons 411/435	Tons 294/315	294/315

Schedule.	Actual.	Schedule.	Actual.	Actual.	Distance.	Stations.	Distance.	Schedule.	Actual.	Schedule.	Actual.	Actual.
Min.	M. S.	Min.	M. S.	M. S.	Miles.		Miles.	Min.	M. S.	Min.	M. S.	M. S.
0	0 00	0	0 00	0 00	0·0	Paddington	67·5	76	82 10 *Sigs.*	70	71 10 *Sigs.*	73 45 *Sigs.*
6	6 55	6	6 35	6 30	3·3	Old Oak Common, W.	64·2	70	70 25	65	65 35 *Sigs.*	65 35 *Sigs.*
--	9 05	—	8 45	8 40	4·6	Park Royal	62·9	—	68 30	—	63 35	63 20
11	12 50	11	12 45	12 35	7·8	Greenford	59·7	65	65 55	60	61 05	60 45
14	15 30	13½	15 25	15 35	10·3	Northolt Junction ..	57·2	62	63 55	58	59 10	58 45
—	19 55	—	20 05	20 50	14·8	Denham	52·7	—	60 20	—	55 35	55 05
—	27 00	—	27 45 *p.w.r.*	29 25	21·7	Beaconsfield	45·8	—	54 15	—	49 40	48 55
32	31 55	31	33 50	34 40	26·5	High Wycombe ..	41·0	45	48 30	42	44 25	43 10
0	0 00	0	0 00	0 00	0·0							
--	8 15	—	8 25	8 25	5·0	Saunderton	36·0	—	43 15	—	39 10	37 45
10	11 50	10	12 00	12 00	8·2	Princes Risborough ..	32·8	36	38 40	33	35 05	33 55
--	16 35	—	16 00	16 10	13·6	Haddenham	27·4	—	32 15	—	*Sigs.*	28 20
20	20 25	19	19 15	19 20	17·7	Ashendon Junction .	23·3	26	27 50	23	23 20	24 25
—	24 10	—	22 00	22 35	20·9	Brill	20·1	--	24 05	—	20 20	21 15
—	29 45	28	26 45	27 35	26·9	Bicester	14·1	16	19 00	—	15 55	16 45
--	34 00	—	30 30	31 20	30·7	Ardley	10·3	--	15 25	—	12 40	13 25

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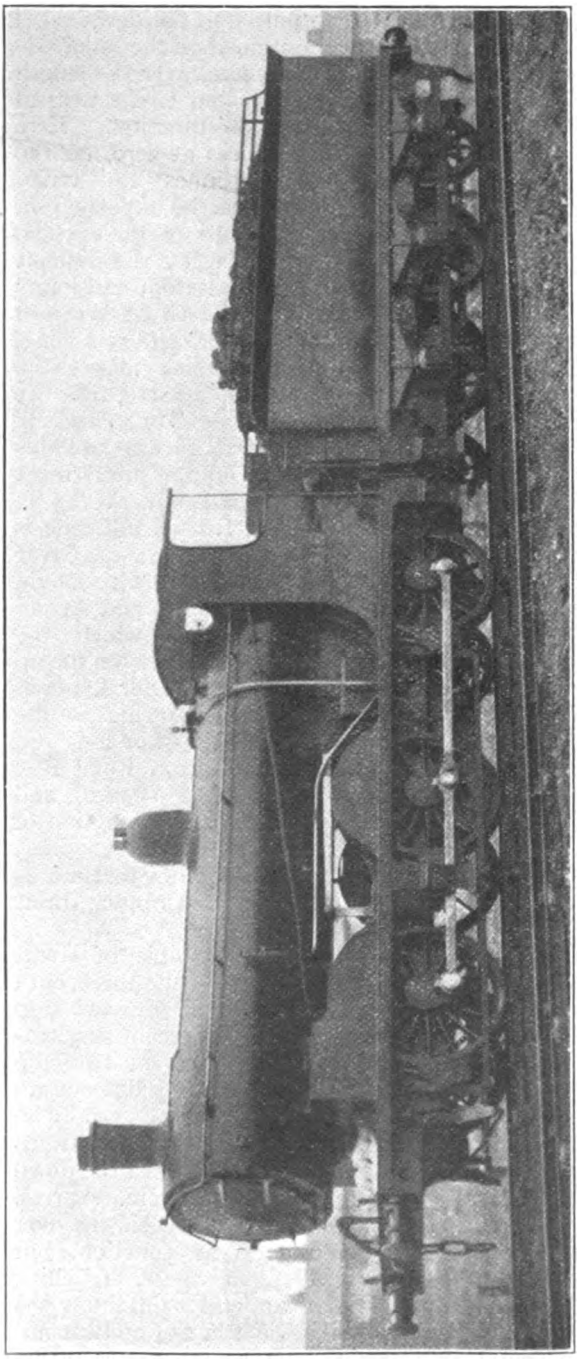
field, after which we got to 72½ m.p.h. before stopping at Wycombe. The succeeding running to Banbury was dull, however, as we did not get above 70 before Ashendon, where we slacked most cautiously; the same rate was reached again at Blackthorn, and 74 before Aynho (with an intervening minimum of 53 m.p.h. at Ardley), whereby we lost over a minut on schedule. But this was more than recouped by a stirring "sprint" from Banbury to Leamington, with a sustained maximum of 75 m.p.h. between Fenny Compton and Southam Road, and a higher speed of 79 between there and Leamington. After Leamington, too, the ascent of Hatton bank was made almost as though it were not there, and touching 74 m.p.h. at Olton we knocked 4½ min. more off schedule on this last length alone, making a total of nearly 7 min. north of Banbury.



LONDON & SOUTH WESTERN RAILWAY.
0-6-0 goods locomotive, rebuilt with "Eastleigh" superheater, &c.

At this stage I might mention, too, a run on the 10.15 a.m. down in the previous 2½-hour era (presumably also the era of those mythical "maximum" speeds of 60 m.p.h. on the Great Western Railway); No. 4031, *Queen Mary*, was the engine, with a really heavy train of 345 tons, all told. Running to Wycombe was good, but not particularly exciting, the time being 34 min. 20 sec., or 33½ min. net. But then, after passing Risborough in 13 min. 35 sec., we did some first-class travelling, getting up to 82 m.p.h. at Haddenham, and again, after easing over Ashendon Junction, to 75 at Blackthorn. The sustained minimum of 51 m.p.h. up Ardley bank was a fine piece of work, and finally, after rolling most gently down to Aynho, we made Banbury in 45 min. 5 sec., although allowed 50 min. for the run! Intermediate passing times were 17 min. 55 sec. to Haddenham, 21 min. 10 sec. to Ashendon, 24¼ min. to Brill, 29 min. 25 sec. to Bicester, 33 min. 35 sec. to Ardley, and 39 min. 10 sec. to Aynho Junction. After waiting a modest nine minutes for

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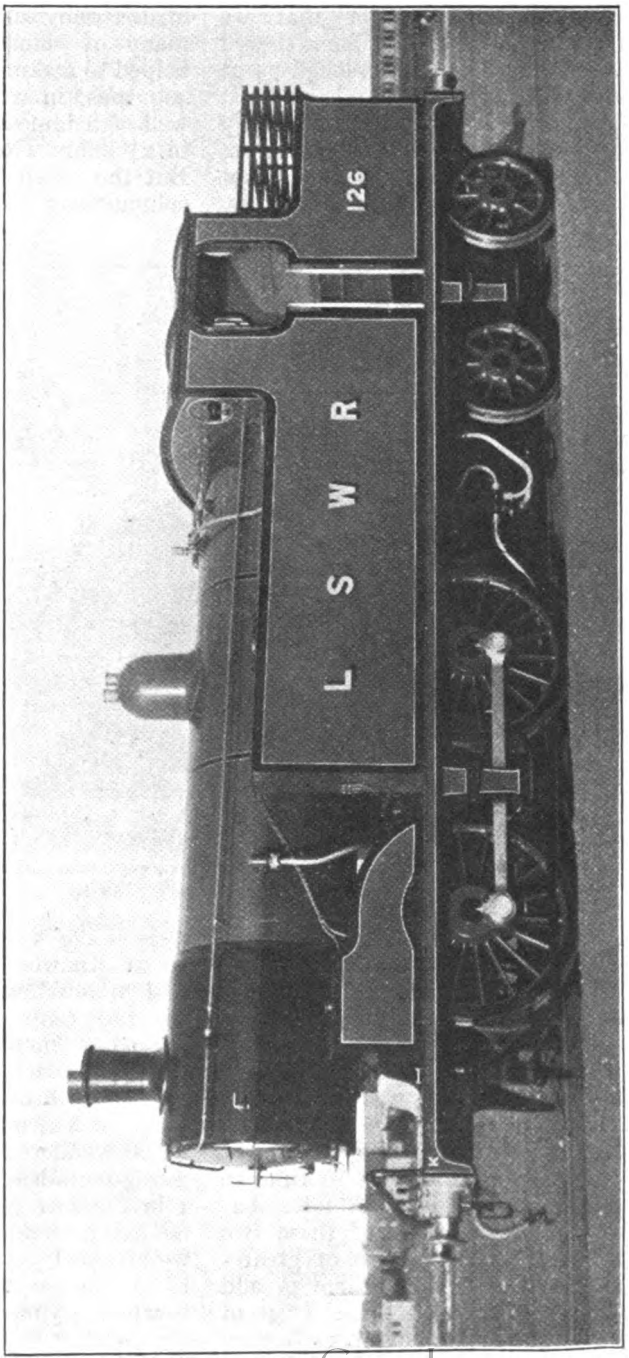
"time" at Banbury, we proceeded on our run to Birmingham with the leisure that the current times demanded.

The second and third down trips in the table were both distinguished by the most care-free start out to Wycombe, followed by a couple of astonishingly fast trips from there to Leamington, in each case in less than "even time," start-to-stop. *King Henry* took a substantial load from the start, of all but 300 tons; we did not get above 58½ m.p.h. at Denham, fell to 51½ at Beaconsfield, and touched 66 before the p.w.r. check, without which our net time from London was 32¾ min. Re-starting, we accelerated to 45 m.p.h. at Saunderton summit, and then followed some terrific speed on to Aynho, with a maximum of 85 m.p.h. at Haddenham and a renewed 80½ at Blackthorn (we slacked less severely than usual at Ashendon); Ardley bank was then "rushed" at a minimum of just over 59 m.p.h., and, running now easily, we touched 70½ before Aynho. I do not expect for some time to repeat our time of 23 min. 15 sec. over the 27·7 miles from Risborough to Aynho—an average of 71·5 m.p.h. over a length far from entirely falling—with 265 tons behind the tender. Between Cropredy and Fenny Compton we had got to 68 m.p.h., when the p.w.r. check came; after that we touched 75 m.p.h. on Southam Road bank, and completed the journey of 60·8 miles from Wycombe to Leamington in 59¾ min. actual time, or from 58½ to 58¾ min. net. The last stage into Birmingham was completely spoiled by a dead stand for signals



LONDON & SOUTH WESTERN RAILWAY.
0-4-4 tank engine, rebuilt with "Eastleigh" superheater, &c.

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at Lapworth, while a laggard goods train was being got out of the way at Knowle, and we arrived 5 min. late.

King James ran distinctly poorly to Wycombe, but after that stirred himself up to deeds almost as doughty as those of his brother monarch. An identical time was made to Risborough; after that we touched 83½ m.p.h. at Haddenham, slowed carefully at Ashendon, and reached 75 at Blackthorn; sustained 60 m.p.h. up most of the upper part of Ardley bank, and only fell to 58½ quite at the top; touched 74 m.p.h. before slowing for Aynho; did not get below 59 on Cropredy bank, and finally deal better than he did on the first stage of his run.

All my three up journeys were made on the 2.55 p.m. from Birmingham, which is in general much the hardest turn of the day, in the up direction at least. During the summer, before the acceleration, it loaded daily to 13 or 14 bogie vehicles, many of which were 70-ft. stock, and helped to make up a gross load of well over 400 tons, in which circumstances it was well-nigh impossible to get up to London in 2¼ hours with two intermediate stops. But the "failure" shown in the first up column was far from discreditable. We

Photo.] LONDON, BRIGHTON & SOUTH COAST RAILWAY. [*C. J. Housego.*

Down Continental Boat Express near East Croydon, 4-4-0 locomotive, No. 70 "Devonshire."

touched 72½ on the first, and 76½ m.p.h. on the second stage of the descent to Leamington. In this case, without signal or p.w.r. checks, we completed the 60·8 miles from Wycombe in 59 min. 35 sec., start-to-stop. A brisk start to Warwick, with a maximum of 53 m.p.h., was followed by a minimum of 46 m.p.h. on Hatton bank, after which a maximum of 67 m.p.h. at Olton was sufficient to maintain time to Birmingham. It is worthy of note that even the startling running of these two journeys was not productive of greater economies on booked time than 3½ and 1 min. respectively, although I grant that *King James* might have done a good were doing 53 m.p.h. at Widney Manor, 60 at Knowle, 68 on Lapworth descent, and 79 at Warwick, so losing only 1¾ min. on the tight booking to Leamington (which is unchanged in the new times), with a 13-coach 435-ton train, reckoned as 58 axles. From Leamington up to Banbury we lost more severely, which is not to be wondered at, in view of the intermediate grades; the sustained rate on the 1 in 187 was 35½ m.p.h., and we touched 66 m.p.h. before Banbury. Re-starting, we attained 53½ m.p.h. before Aynho, fell to 40 on the ascent to Ardley Tunnel, touched 76½ on Bicester bank, dropped to 37½ on the 1 in 167 to Saunderton summit,

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and reached 64½ before slacking for West Wycombe. A magnificent recovery was made from High Wycombe, with an attained speed of 55½ m.p.h. on the short subsequent level stretch, and a minimum of 52½ at Beaconsfield; after that we reached 80 m.p.h. at Denham, and were still doing 76½ at Greenford. But for the concluding delays, we should have kept exact time from Banbury—a very fine feat, with such a train—but we were held for no less illustrious express than the up "Limited," itself well behind time, and arrived 15 min. late.

been impossible for the most trained of observers to have detected from the running that the usual type of engine was not at the head of the train.

Thus, in getting away from Snow Hill, the 4-6-0 led as far as Knowle, passing Bordesley at 45 m.p.h., Solihull at 59, and Knowle at 67 m.p.h., whereas the figures of the "County" were 42, 56½ and 66 respectively. But on the Lapworth "dip," the respective maxima were 75 and 76½ m.p.h., and descending Hatton bank 71½ (the 4-6-0 was braked here) and 79 m.p.h.; consequently, with a fast

Photo.] GREAT CENTRAL RAILWAY. [*H. T. Worlock.*

6.10 p.m. Marylebone-Manchester express, hauled by 4-4-2 locomotives Nos. 264 and 263.

The last two trips were made on the present 125-min. schedule, and their interest lies in the comparison between the work of a four-cylinder 4-6-0 "Star" and a two-cylinder 4-4-0 "County" on the same timing with the same load. The latter was provided at short notice in place of a "Star" which had failed temporarily, and Driver Evan Williams' work in these circumstances was one of the finest things of its kind that I have noted for many a long day. Indeed, except for the slightly slower starts made by the four-coupled engine it would have

finish, the 4-4-0 led the 4-6-0 into Leamington by 5 sec., both runs being made, with these substantial trainloads, in a shade over "even time." From Leamington, the bigger engine had the best of it at the immediate start, but up the 1 in 187 the 4-4-0 accelerated to and maintained 45½ m.p.h., against the 4-6-0's 43½; unfortunately the "County" now got checked by signal, but the maxima before stopping at Banbury were 69 and 67 m.p.h.

We then set out on our booking of all but 58 m.p.h. from Banbury to Paddington.

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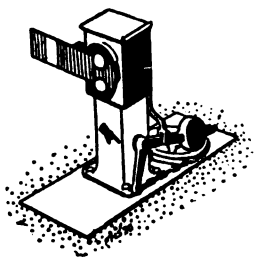
Here the 4-6-0 led as far as Ashendon Junction, touching 62½ m.p.h. at Aynho, maintaining 52 m.p.h. up the 1 in 200 to Ardley Tunnel, and doing a level 83½ at the bottom of Bicester bank, with a minimum of 69 on the ascent past Brill; the "County's" corresponding figures were 60, 50, 82 and 62½ m.p.h. Both engines were slackened carefully over Ashendon Junction, and the 4-6-0 then suffered a cruelly bad check at Haddenham, evidently from an up goods train being shunted at Risborough—in my opinion, a particularly inexcusable delay on a route so little congested with traffic, and yet fully provided with passing loops, none of which, as we had passed them, had been occupied from Bicester onwards. The "County" reached 62½ m.p.h. on the level near Haddenham, had fallen to 53 at Risborough, and the minimum at the summit of the 1 in 167 was 46½ m.p.h.; the 4-6-0 had no chance of a proper recovery before commencing on the ascent, and fell to 43½ m.p.h. The latter also ran cautiously down Saunderton bank, whereas the "County" touched 71½ m.p.h., but slowed the more carefully through West Wycombe; both engines were brought down to the full limit at High Wycombe. Then came an astonishing feat on the part of the 4-6-0, which on the short level strip after Wycombe reached 60 m.p.h., and never fell below 57½ on the succeeding 1 in 225; the "County" got up to 56½ and fell to 52½ m.p.h. The 4-6-0 reached 80½ m.p.h. at Denham, and renewed this speed at Greenford, with an intervening "minimum" of 75; the corresponding figures of the 4-4-0 were 79, 76½ and 72½ m.p.h. The customary delays at the finish of the journey, more pronounced on the second than on the first run, brought us late into Paddington by 6 and 8½ min., but the net running times were not more than 67½ min. ("even time"), and 70 min. respectively.

Magnificent though the work of the 4-6-0 was throughout, with its net economy of 4 min. on schedule times, there is no doubt in my mind that chief honours must go to *County of Bedford*. I would barely have believed it possible for a 4-4-0 engine hauling, with tender, precisely six times its own weight, to make such times over a road of this grading, and my congratulations at the close of the journey to Driver Williams (with whom I had had no word before starting) will, I feel sure, be joined in by many readers. The only other comments I would make on these journeys is that it seems a pity that the painstaking efforts of the drivers towards timekeeping are not aided a little more by the working *en route*; in addition to the delays mentioned, some of which seemed clearly avoidable, overtime was spent at all stops. The 3 min. allowed at Leamington were expanded by 80 sec. and 30 sec. on the two last-mentioned trips, and the 2 min. at Banbury by 50 sec. and 55 sec., while on the last journey even the 9 min. scheduled at Snow Hill was not sufficient, and we stood there for 11 min. 5 sec.! Such defects as these would appear capable of remedy, and their loss would help to the maintenance of that strict punctuality so essential in a competitive business service of this character.

And now, I fear, considerations of space must intervene to compel me to postpone my London and North Western Birmingham journeys until next month. Perhaps it as is well, as then I may have room also for the description of certain other noteworthy recent journeys over the latter line.



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THE RAILWAY PORTRAIT GALLERY.

Photo.] [*Werner & Son.*

MR. J. R. BAZIN,

Chief Mechanical Engineer, Great Southern & Western Railway, Ireland.

MR. J. R. BAZIN was appointed in November, 1921, Chief Mechanical Engineer of the Great Southern & Western Railway in succession to Mr. E. A. Watson. Educated at Berkhampstead; in September, 1897, entered Doncaster Works, Great Northern Railway, as a premium apprentice; engaged for three years on shop work, and then transferred to the Running Department, attached to running sheds and firing on locomotives; appointed an acting inspector in the Locomotive Running Department; in March, 1905, appointed Assistant to the London District Locomotive Superintendent in charge of Hornsey shed; in August, 1905, became Assistant District Locomotive Superintendent at Colwick, Nottingham; in September, 1906, transferred to a corresponding position at Peterborough; in May, 1908, appointed Assistant Works Manager at Doncaster, and in March, 1916, Acting Carriage and Wagon Superintendent; and in May, 1919, became Works Manager at Inchicore, Great Southern & Western Railway.

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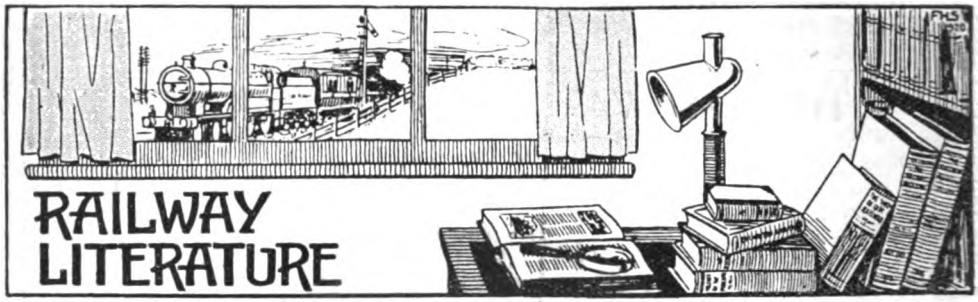

A Story of Railway Pioneers. By Major S. Snell, M.C. (ex-R.E.). [Selwyn & Blount, Limited, 21, York Buildings, Adelphi, W.C.2. Price 12*s*. 6*d*. net.]

This volume is described as "An account of the inventions and works of Isaac Dodds and his son Thomas Weatherburn Dodds." Isaac Dodds, who was born in 1801 and employed at the age of 12 years at Killingworth Colliery, was early associated with George Stephenson, but most of his work was done as an independent engineer, in which capacity he was connected with the design of a number of early locomotives, including two of Killingworth type for the Monkland and Kirkintilloch Railway, as early as 1830, and was responsible for many inventions relating to locomotive engineering, including a metallic packing and a balanced slide valve, as well as in connection with other sections of engineering. Later he produced the wedge motion shifting eccentric with which his name was associated and which was used to some extent on several railways. From 1838 to 1845 he was solely occupied in the improvement and manufacture of railway appliances. Dodds also launched out into bridge engineering and railway construction, among his undertakings being the construction of a railway in Spain from Santander to Alar del Rey. In 1850 Dodds reopened the Holmes Engine Works at Rotherham, near Sheffield, in conjunction with his son, the firm being known as Dodds & Son, taking up the manufacture of steel for railway purposes, Isaac Dodds being a pioneer in advocating the wide use of steel in place of iron for railway rails and other railway purposes. In due course the firm executed a number of orders for locomotive engines and for railway material and appliances for railways at home and abroad, besides undertaking marine and general engineering work. The construction of the Spanish railway mentioned was also carried out by the firm, the line being completed in 1858. In 1866 the construction of six express locomotives for the London, Brighton and South Coast Railway was undertaken, but only one was completed, and a second partially, owing to the closing down of the Holmes Engine and Railway Works in 1868; Isaac Dodds died on November 1, 1882. His son, T. W. Dodds, became Engineer and Locomotive Superintendent of the North Staffordshire Railway. In 1884 he became General Manager of the Sante Fé Colonial Railways, but returned to England in 1887. In 1892 he was associated with the Buenos Ayres and Pacific Railway, becoming General Manager, with a seat on the board of directors in Buenos Ayres, until ill-health forced him to retire in 1896. This volume is interestingly written and contains many items of information which will be appreciated by students of locomotive and railway engineering development.

The Mechanical Handling of Goods. By C. H. Woodfield. [Sir Isaac Pitman & Sons, Limited, Parker Street, Kingsway, W.C. 2. Price 2s. 6d. net.]

This volume, added to Pitman's series of technical primers, describes modern methods and equipment for the mechanical handling of goods in and about factories, workshops, warehouses, stores, power houses, &c. It is designed for engineers, works managers, students and others, and besides economical discussion and descriptions of practice, includes much useful data. Chapter I deals with the economics of the subject. Succeeding chapters cover pulley blocks, crab winches and derricks, friction hoists, overhead runways and trolleys, overhead travelling cranes, electric mono-rail hoists, self-landing and delivering hoists, cantilever and transporter cranes, gravity runways and shoots, stacking machines, band and bucket conveyors, and electric storage battery trucks. The final chapter deals with portable jib cranes, runway accessories, and the strengths of wire rope and chains. The volume is clearly written, with numerous diagrams and a number of half-tone examples.

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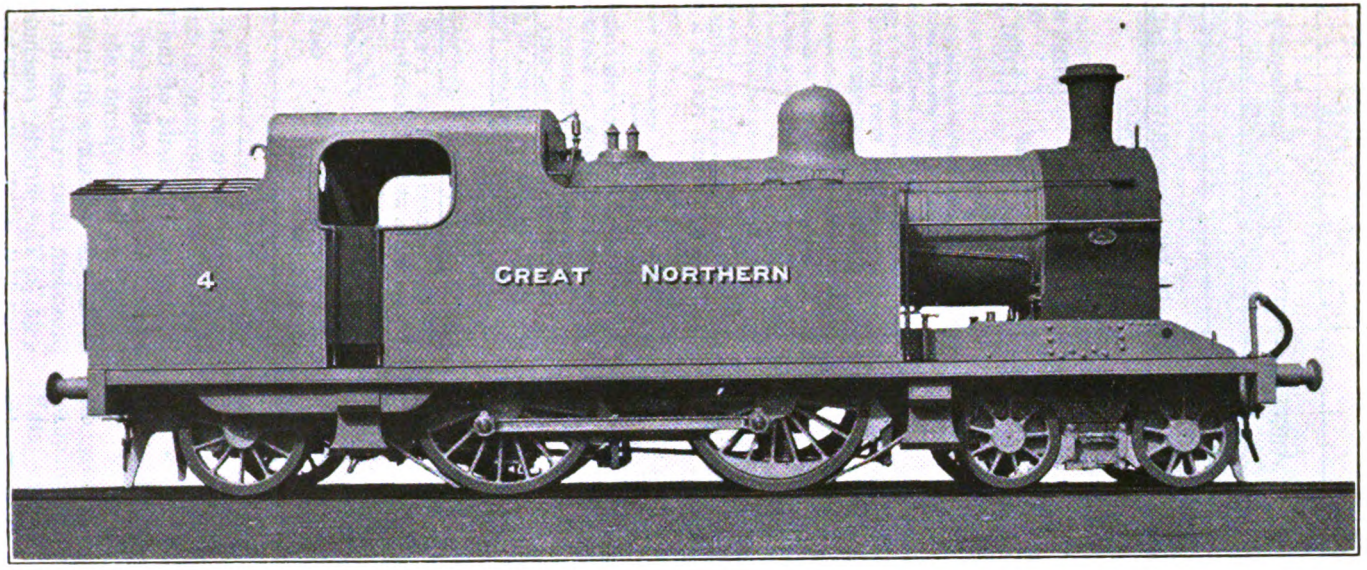
4-4-2 SUPERHEATER TANK ENGINE, GREAT NORTHERN RAILWAY OF IRELAND.

Mr. G. T. GLOVER, Locomotive Engineer.



THESE engines, built by Beyer, Peacock & Co., Limited, are a development of a corresponding non-superheater class introduced several years ago. In regard to many parts the two classes are interchangeable, as also with the Class " U " small-wheeled light traffic class of 4-4-0 tender engines. Five of the new engines (Class " T2 ") have been constructed, the non-superheater class (Class " T ") also numbering five. Among the new features, apart from those due to the provision of superheating apparatus, are the " Ross " safety valves and the brake mechanism fitted to the bogie wheels.

Cylinders	18 in. × 24 in.
Coupled wheels	5 ft. 9 in. diam.
Bogie wheels	3 ft. 1½ in. diam.
Trailing wheels	4 ft. diam.
Steam pressure	175 lb. per sq. in.

Weight in working order, 65 tons, 15 cwt.

Heating surface—Tubes	757 sq. ft.
Firebox	106 ,,
Superheater	193 ,,
Total	1,056 ,,
Grate area	18·3 ,,

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"ECONOMY AND CO-OPERATION" FOLDER, GREAT WESTERN RAILWAY.

A Few Words to Great Western Railway Employees

ECONOMISE.

Railway Revenue follows the Trade of the Country.

When Trade is Bad, Railway Revenue Falls.

Out of Revenue has to be found the Money required for Wages, Salaries, Equipment, Stores and the like; in fact, all Expenditure.

It follows that in times of Trade Depression it is essential to keep Expenditure down for NO CONCERN CAN RUN ON LOW REVENUE UNLESS EXPENDITURE IS KEPT DOWN.

Every Employee can assist in reducing Expenditure by Exercising Care in the Use of Tools and Appliances and Rigid Economy in the Consumption of Stores, Stationery, Coal, Gas, Oil and all the miscellaneous consumable articles used on the Railway, all of which represent money.

DO YOU REALISE THAT—

A Shunting Pole costs 4/-
A Wagon Sheet costs 100/-
A Guard's Hand Lamp costs 17/-
A Platform Broom costs 4/-
A Packer's Shovel costs 4/-

Point Oil costs 1/- per gallon
Petroleum costs 1/2 per gallon
Engine Motion Oil costs 2/- per gallon
Motor Car Lubricating Oil costs 2/- per gallon
and so on?

DO YOU KNOW THAT THIS RAILWAY USES ON THE AVERAGE—

THREE AND A HALF TONS OF COAL
and
ONE AND A HALF GALLONS OF PETROLEUM
} **EVERY MINUTE OF EVERY DAY?**

There are a thousand and one ways in which economies can be effected and every man should do his best to keep down expenditure. More than that, it is essential AND IN THE BEST INTEREST OF EVERYONE CONCERNED.

As an example of possible economies:

Every time a sheet tie is thoughtlessly cut, instead of being untied, it costs a halfpenny for replacement. A small sum in itself but applied all over the line it becomes a heavy item of expense. Last year the Company spent over SEVEN THOUSAND, FIVE HUNDRED POUNDS in Sheet Cord alone.

This is only one of innumerable examples which might be quoted.

IF EVERY EMPLOYEE OF THE COMPANY WOULD ECONOMISE IN MATERIALS, STORES, TOOLS, STATIONERY, ETC., TO THE EXTENT OF SIXPENCE PER WEEK, AN ANNUAL SAVING OF OVER ONE HUNDRED THOUSAND POUNDS WOULD RESULT.

THINK IT OVER. ACT NOW.

THE CO-OPERATION OF EVERY EMPLOYEE IS REQUIRED AND SOLICITED.

F. J. C. Pole

PADDINGTON STATION,
LONDON, W.2.
December, 1921.

General Manager

BY the courtesy of Mr. F. J. C. Pole, General Manager of the Great Western Railway, we are enabled to reproduce the text of a folder entitled "Economy and Co-operation," which has been distributed to each of the 90,000 members of the Great Western Railway staff. A flap inside the folder carries the injunction "ECONOMISE" in clear letterpress, and gives point to the text which insists that economy is efficiency without waste.

An instructive article in the January issue of the Company's staff Magazine, discussing the issue of the folder, states that, "What is called for, and urgently called for, is the same care and economy in the use of stores and materials as the provident man exercises in the use of his own." The article concludes with the remark that "Results will be in proportion to the effort made. Nothing really good is achieved without enthusiasm, but with a staff of 90,000 enthusiastic economists much should be achieved."

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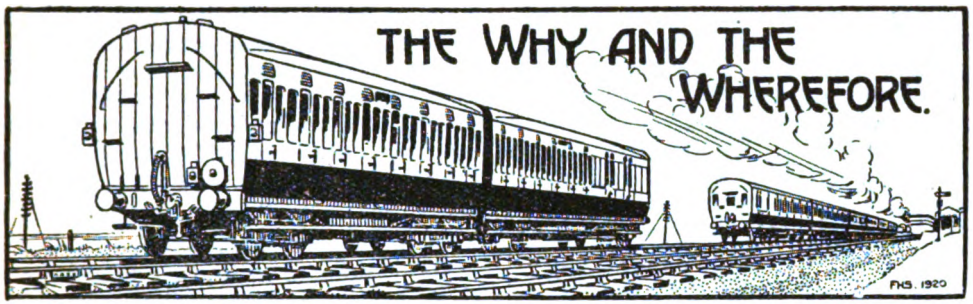

RAILWAY MAGAZINE *readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to locomotive sheds and to the dimensions of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. No reader should forward more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history and the like, readers should consult the pages of the "Railway Year Book." The twenty-fourth Annual Edition of this standard railway reference work is on sale, 5s. net, or by post, 5s. 9d. A new edition, to be published in April, 1922, is in preparation.*

London & North Western Railway and Midland Railway connections near Boxmoor and St. Albans.

In answer to these queries, the London and North Western Railway have gone to some trouble to supply the following information:—(1) The Hemel Hempstead and London and North Western Railway was authorised by the Act of 1863 to commence by a junction with the London and North Western Railway at or near Boxmoor station and to terminate at Hemel Hempstead. By the Act of 1866 this line was extended to Harpenden and by the Act of 1872 a short railway was authorised on the north side of Boxmoor station. The deposited plans of 1872 show that there was a turntable connection with the London and North Western Railway in Boxmoor goods yard. The railway was opened for traffic from Hemel Hempsted to Harpenden in 1877, and was worked by the Midland Railway Company under the terms of an agreement dated December 1, 1876, which agreement was confirmed by the Midland Railway (Further Powers) Act, 1877. By the Midland Company's Act of 1886 the Hemel Hempsted and London and North Western Railway became vested in the Midland Railway. The connections in the goods yard at Boxmoor were removed in 1897. (2) The junction of the Midland Railway with the London and North Western Railway, near Park Street, St. Albans, was authorised by the Midland Railway (New Lines and Additional Powers) Act, 1864, and a sum of £100 paid for easement in April, 1867, but so far as can be ascertained the junction itself was never laid in, although the materials were on the ground and a small wooden signal box was provided for working the connection.

[Reply to G. W. B.]

French Railway Speeds.

In response to your questions, Lord Monkswell, the author of the well-known work, *French Railways*, writes:—

(1) *Fastest booked run at present time.*—There is a train on one day of the week only which runs from Paris (Nord) to Arras (192·1 kilos, or 119¼ miles) in 128 minutes, and a similar train on the same day in the opposite direction.

(2) *Best booked run in* 1914.—Nord express, Paris to St. Quentin (153·1 kilos, or just over 95 miles) in 94 minutes. At one time the train had 93 minutes for this run.

(3) *Longest run.*—I know of none longer than that between Chartres and Thouars (147¾ miles) on the State line before the war. At present the longest is probably that between Paris and Arras.

I am not sure that the Méditerranée–Calais train was ever actually timed between Paris and Amiens in 77 minutes, though this timing was proposed. I rather think the French Government officials refused to sanction it. When I travelled by this train in April, 1902, the

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time was 81 minutes in the working time-tables, but when the train started late time was made up. I travelled by this train on two successive days, the train on each occasion weighing about 170 tons behind the tender. On the first day we took 73 min. 33 sec. to Amiens (81¼ miles), and on the second 75 min. 20. sec. On each occasion there was a severe slack for p.w. repairs just outside Amiens. Engines Nos. 2645 and 2642 (4-4-2).

[Reply to J. C. SEARLS.]

"Single" Locomotives, Midland Railway.

Mr. C. R. Clinker mentions that No. 679, stated by Mr. R. H. Coe to be "apparently derelict" at Bromsgrove, was pilot to the 9.10 a.m. train from Bristol to Gloucester when he travelled by it on November 23 last. Mr. F. H. Stingemore mentions Nos. 690, 613 and 615 at work in the London district during the summer months, but withdrawn about September, on local trains or piloting express and goods trains. The last to be seen regularly piloting expresses was No. 659 in 1920. From the derelict roads at Kentish Town, Nos. 687, 685 (*Princess of Wales*), and 691 have gone. Some may reappear from Derby, as did No. 645, early in 1921, newly painted.

[Further reply to A. H. HARRISON.]

Lancashire and Yorkshire Express Engines at Crewe.

An interchange of Horwich and Crewe-built express engines is in progress, for which purpose one or two of the rebuilt Horwich 4-cylinder 4-6-0's are at present stationed at Crewe. Recently one of them worked successfully on a non-stop express between Crewe and Carlisle. Similarly both "Prince of Wales" and "Claughton" class London and North Western 4-6-0's are working over the Lancashire and Yorkshire section of the now joint system, including the Blackpool trains. No results of the trials have been made public.

[Reply to R. HOGAN and A. PRINCE.]

The Kearney High-Speed Railway.

Thanks for copy of "Science Cuttings," published by the Coopers' Company's School Science Society. It is a neat little publication of its kind, and we are glad to note that you appreciated the demonstration of the Kearney High-Speed Railway. But it does not follow that its construction is a commercial proposition. Gravity is a very good servant, but for each descent an ascent has to be climbed, and the chief gain of the system, if it is not neutralised by other considerations, is that the stations can be built near the surface.

[Reply to C. F. KLAPPER.]

Avonmouth Line, Great Western Railway.

Mr. J. Brander writes that an unfinished bank exists to connect the Avonmouth line from Filton Halt to Patchway, apparently constructed from material obtained during the construction of Henbury tunnel. The road has not, however, been properly levelled and ballasted, though contractors' rails were laid thereon. He suggests that the intention was to complete this link, which would facilitate traffic which now has to be reversed at Stoke Gifford.

[Further reply to "SILURIAN."]

Lickey Incline, Midland Railway.

Commences at Bromsgrove and terminates at Blackwell, two miles at 1 in 37·7 to be ascended by trains from Bristol towards Birmingham. All trains, except a few very light ones, are assisted by bank engines, usually even when already double-headed. Heavy trains may have two banking engines, unless the big four-cylinder 0-10-0 is employed. Descending trains also require to stop at the top of the bank, and generally at the foot also, to ensure that they are kept well in hand.

[Reply to "SILURIAN."]

Sheffield Railway Stations.

Sheffield (Victoria), the Great Central station, and Sheffield (Pond Street), the Midland station, are about three-quarters of a mile apart. Midland trains can travel from Chesterfield either via Dore and Totten and Sheffield, or via Killamarsh to Rotherham, in which case connections are given to or from Sheffield. Information of this character can be ascertained from the RAILWAY YEAR BOOK, particularly the Midland map, with the aid of *Bradshaw* or a Midland Railway timetable.

[Reply to "SILURIAN."]

Templates on Great Western Carriages.

The structure you noticed applied at one end and about midway of a bogie coach is a template to indicate maximum dimensions of larger vehicles in order to

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ascertain whether the latter can be safely run over certain sections of the line and will clear platforms, bridges, etc. Apparently, it is desired to extend the availability of the larger vehicles which are not at present allowed to run on sections where restrictions apply.

[Reply to "7300."]

"736" Class 4-6-0's, London and South Western Railway.

Boilers of these engines are not pitched any higher than is necessary in order to clear the coupled wheels and motion, and this height is in no way exceptional. By "main frames" we imagine you mean the outside framing, or running-plate (a very different thing); this is run high up to render wheels and motion readily accessible. We have no information on the matter you raise in regard to No. 738.

[Reply to F. P. MILLARD.]

"Ragtime" Class, Great Northern Railway.

A Peterborough reader in close touch with Great Northern locomotive matters suggests that the original "1630" class "Moguls" were the first to receive this *soubriquet* among the enginemen—doubtless owing to the inaugural appearance of outside Walschaert motion on that line, coupled with the small driving wheels. The first "Consolidation" mineral engines, he adds, were dubbed the "Tangos."

[Further reply to F. W. LUPTON.]

Rebuilt Locomotives.

Technically, a locomotive is considered as "re-built" after the first renewal of the boiler, even though a boiler of identical design to that removed be substituted. From the operating point of view, a class of engines is only termed as rebuilt after they have been structurally modified in some more extensive way. The North British engine you mention has been re-boilered only.

[Reply to R. MCCULLOCH.]

Most Powerful Locomotives.

Full dimensions of the locomotives you mention have all been given in the pages of the RAILWAY MAGAZINE, and it is only necessary for you to calculate the respective powers by means of the formula given [illegible] attempt to describe one as more useful than another.

[Reply to R. J. C. WOODING.]

Railway Electrification.

Copies of the interim and final reports of the Electrification of Railways Advisory Committee can be purchased from His Majesty's Stationery Office, Kingsway, London, W.C. No actual report of Great Eastern Railway electrification proposals was published; they were made known by remarks at the annual meeting and by newspaper comments based upon statements by officers of the railway.

[Reply to H. G. MACLEAN.]

Sunday Trains.

Until recent years most railways observed the morning "Church Interval" on Sunday mornings, and it is quite a modern development to run trains between 11 a.m. and 1 p.m. In many cases the principle is still maintained, especially where a district has no special holiday interest, and this probably explains the absence of trains about noon in the case you mention.

[Reply to A. G. BICKERSTOFF.]

London, Brighton and South Coast and South Eastern Joint Lines.

The fact that these lines will come into the ownership of the Southern Group will facilitate electrification of the Sanderstead-Oxted and Croydon-Redhill (via Merstham) sections. By the time work can be put in hand it will be practicable to adopt one system or the other without complications due to dual ownership and conflicting ideas.

[Reply to "VOELAS."]

The Railway Magazine and Grouping.

We are not anxious as to possible falling off in subject matter of interest for RAILWAY MAGAZINE readers when grouping is realised. It will be years before most of the individualistic characteristics disappear, and by that time the changed conditions will have created new interests, possibly even more important than those of to-day.

[Reply to G. ROBINSON.]

Great Northern Railway Slow Roads.

[illegible] are signalled on the [illegible]

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missive block system, and used only by freight trains. The section Stevenage to Knebworth is one of the exceptions, and the absolute block system being installed thereon, it is available for passenger trains.

[Reply to A. G. BICKERSTOFF.]

Head Lights, London, Brighton & South Coast and South Eastern Railways.

Green headlights were abolished on the London, Brighton and South Coast Railway in 1917. They are still used to some extent on the South Eastern and Chatham Railway, though we understand that a revision to abolish the green light is now under consideration in the case of this railway.

[Reply to "PISTON VALVE."]

Smoke and Railway Photography.

Occasionally an engine is fired before reaching the spot where a photographer is known to be waiting, but this is not usual, and we understand that Mr. F. E. Mackay obtained the view you mention without any pre-arrangement; the section being a hard one where good smoke effects could be expected.

[Reply to G. ROBINSON.]

London and South Western Railway Speeds.

We have not the details of the speed records you mention, but know of no higher on the London and South Western Railway. The highest recorded by Mr. Cecil J. Allen on this railway has been 86½ m.p.h., also behind a Drummond 4-4-0 of the "706" class.

[Reply to L. A. GARRARD.]

Great Eastern Railway Engine at Manchester.

Through Great Eastern Railway workings to the Manchester district are by no means uncommon. They are generally connected with race meetings, and rebuilt 4-4-0 No. 774 had probably come through from Newmarket with a special for Manchester Races.

[Reply to R. M. SHAW.]

Summit Level, London & North Western Railway

Shap is the main line summit level, but [illegible] works, where it is 1,268 ft. This point will be made clear in the 1922 RAILWAY YEAR BOOK.

[Reply to A. ALDRIDGE.]

"Pop" Safety Valves.

Among early users were the Metropolitan and London, Tilbury and Southend Railways, but cannot say which line was the first to use the Ross type. Th Drummond type used on the London and South Western, and before that on some of the Scottish lines, was of the same class.

[Reply to G. M. MACKAY.]

Forth Bridge.

For details of the construction of the bridge and in regard to methods of allowing for expansion in the case of large bridges, we must refer you to text-books on bridge engineering. See "Railway Bibliography," page 347, RAILWAY YEAR BOOK, 1921.

[Reply to A. G. WOODGATE.]

Locomotive Lists.

Thanks for your notes concerning new North Eastern Railway locomotives. Your request for particulars of all Highland Railway 4-6-0 locomotives cannot be complied with; it is against the rules, and if such a list were given it would take up far too much space.

[Reply to R. HAIGH.]

Joint Lines and Grouping.

It is not yet clear how these will be dealt with under grouping, where the interests of separate groups are involved. It will still be possible to operate them by joint committees, or arrangements may be made for transferring some of them to one of the companies concerned.

[Reply to A. C. EDWARDS.]

Pullman Cars on Great Eastern Railway.

Pullman Cars on this railway do not imply any connection with the London, Brighton and South Coast Railway. The Great Eastern Railway runs an extensive service of first and third class Pullmans on the principal main line trains.

[Reply to "MIDLAND LOCO."]

Locomotive Boiler Explosions.

[illegible] mention at Rugby about 1853, was so

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long ago that it would hardly come into present official records.

[Reply to REV. H. C. COURTNEY.]

Compound "Atlantics," Great Northern Railway.

Of the three compounds, Nos. 292, 1300 and 1421, No. 1300 was rebuilt some time ago as a 2-cylinder simple, and we believe that No. 1421 has been treated similarly. We have no recent information in regard to No. 292, nor space in which to give dimensions.

[Reply to H. J. J. GRIFFITH.]

Midland West of England Line.

There are possibly considerations of weight which prevent the compounds working west of Derby, although at the same time, in view of their limited number, they could probably be ill spared from their more important duties over other parts of the system.

[Reply to H. J. J. GRIFFITH.]

Great Central Railway Train Services.

Important economic questions enter into the matters you mention. Difficulties in regard to engine working, such as you describe, are common to almost all our railways owing to shortage of stock arising out of war arrears of maintenance.

[Reply to "G. C. ADMIRER."]

South Eastern and Chatham Locomotives.

No. 781 is one of the large Wainwright-designed superheated 4-4-0's of the English-built series; No. 497, prior to rebuilding, was a Wainwright 4-4-0 of the standard type. Please read the rules at the head of these columns.

[Reply to C. H. FREND.]

Locomotive Regulators.

We are not aware of any usual locomotives having more than one regulator; you must explain yourself more clearly. A few shunting and tramway type engines have this feature, but only to enable them to be worked from one end or the other.

[Reply to "PEACOCK."]

North Eastern Railway, Three-cylinder 4-6-0 locomotives.

An Edinburgh reader writes that he observed No. 943, of the "S 3" express goods class, arrive in Waverley station on the train due at 3.48 p.m., the continuation of the 1.55 a.m. from London, King's Cross.

[Further reply to A. J. T.]

Faversham Station, South Eastern and Chatham Railway.

We have no definite information, but understand that there are up and down island platforms to enable connecting trains to interchange passengers, etc., in each direction. The junction comes under usual instructions as to speed.

[Reply to F. BURTON.]

No. 4118, "Waterford," Great Western Railway.

This engine, previously No. 3310, appears in the current Great Western Railway locomotive list, classified with the "Flower" series. Our information is that all the "Badminton" class now have standard domeless boilers.

[Reply to R. W. HANBRIDGE.]

Mile Posts, South Eastern and Chatham Railway.

Plain numbers are given at each mile, and one, two or three dots are added to indicate the quarter, half and three-quarter mile distances. No attempt is or could be made to show distances from the various termini and by each route.

[Reply to P. M. SELBY.]

Great Western Trains to Liverpool Street.

These are worked by steam locomotives on the Great Western Railway and by Metropolitan Railway electric locomotives between Liverpool Street and Bishop's Road, Paddington, where the change is made.

[Reply to G. N. SOUTHENDEN.]

Compound Locomotives.

Each individual compound locomotive class has its own distinguishing features, which are too numerous to detail here, but there is no special feature common to *all* compounds by which they may be recognised at sight.

[Reply to "COMPOUND."]

The "Exeter" Railway.

This independent railway, worked by the Great Western Railway, from Exeter to Heathfield on the Moretonhampstead branch, leaves the main line at City Basin Junction, 1½ miles beyond St. David's Station.

[Reply to "CYPRUS."]

British and Continental Railway Gauges.

Mr. H. V. Borley points out a clerical error in the recent reply on this subject.

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The Continental gauge is 1,440 mm., the British gauge being 5 mm. less, or less than a quarter of an inch.

[Further reply to Rev. H. C. COURTNEY.]

Chesterford and Newmarket Railway.

W. J. Scott, B.A., writes: In *Bradshaw* for March, 1849, and for March, 1851, the intermediate stations between Chesterford and Six Mile Bottom are given as Bourne Bridge and Balsham Road respectively.

[Further reply to "ANGLO SCOT."]

North British Railway Locomotives.

We are not aware of oil-fired engines having been tried on the North British Railway. One of the "Glen" class superheated 4-4-0 engines is fitted with the Weir feed-water heater and pump.

[Reply to R. MCCULLOCH.]

Great Central Railway Distances.

Grendon Underwood Junction to Calvert, 1 mile 77 chains; Quainton Road Station and Quainton Road Junction, 26 chains; Braunston and Charwelton, 7 miles 3 chains.

[Reply to C. R. CLINKER.]

Railway Electrification in the Birmingham District.

We are not aware of any proposals for electrifying railways in the Birmingham area, though in many cases they would afford admirable opportunities therefor.

[Reply to H.G.H.]

Lengths of Locomotives.

This is hardly a useful dimension where the tender is omitted, and it would be necessary to consult detail drawings to ascertain it.

[Reply to H. S. SLACK.]

World's Longest Railway Tunnel.

The Simplon, 12 miles. The Great Northern Railway signalling school at Retford has not been described in the RAILWAY MAGAZINE.

[Reply to R. GILLAM.]

North British Railway Locomotives.

Mr. J. J. Cunningham points out that 4-4-2 engine, No. 901, is named *St. Johnstoun*, while No. 902 is *Highland Chief*.

[Further reply to A. W. YOUNG.]

Southcote Junction, Great Western Railway.

Apparently you refer to the branch to Reading Central goods station from Colev Branch Junction.

[Reply to G. N. SOUTHENDEN.]

Welwyn Viaduct.

Digswell Viaduct, Welwyn, Great Northern Railway, includes 40 spans, each of 30 ft. The total length of the viaduct is 98 ft. It was opened in August, 1850.

[Reply to A. B. N.]

"Chairman" Class 0-4-0 Tank Engines, Great Eastern Railway.

There are several engines of this type extant; one is stationed at Colchester, and works regularly in Hythe goods yard.

[Reply to H. H. BELL.]

Electric Locomotives.

The City and South London is the only British electric railway to use independent electric engines on *all* trains.

[Reply to "ENQUIRER."]

Junction near Fishguard.

Old route *via* Rosebush and new route *via* Clarbeston join at Letterston Junction, three miles from Fishguard Harbour.

[Reply to "ENQUIRER."]

New Mills-Cheadle Heath, Midland Railway.

We know of no special name for this section; it forms part of the Midland main line from London to Manchester.

[Reply to "BESSEMER."]

Single (Main) Lines West of Plymouth, Great Western Railway.

Beyond Saltash the next single line section is from Scorrier to Drump Lane (Redruth).

[Reply to E. A. BEET.]

Engine Sheds, London and North Western Railway.

See list in RAILWAY YEAR BOOK, 1921, page 180. Your list is incomplete and wrong in some cases.

[Reply to R. HASEMAN.]

Scissors Crossings.

Mr. F. J. Brymer mentions that a good example can be seen outside the north end of York station.

[Further reply to A.B.F.]

Midland 4-4-0 No. 768.

Cylinder and pump on the right-hand side of the engine are the Weir feed-water heater and feed-pump.

[Reply to "MIDLAND LOCO."]

Sapperton Bank, Great Western Railway.

Inclination of this bank (between Swindon and Cheltenham) is 1 in 75 for nearly three miles.

[Reply to B. A. BIGGS.]

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Largest Railway Station in the World.

New York Central Railroad's Grand Central Terminal in New York, with 43 platforms, on two levels.

[Reply to T. W. LINSELL.]

Railway Gauges.

Western Australia, 3 ft. 6 in.; Trans-Australian Railway, 4 ft. 8½ in.; Shangai-Nanking Railway, 4 ft. 8½ in.

[Reply to F. L. HARRIS.]

Carlisle-Glasgow, Glasgow and South Western Railway.

Some years ago, for one season only, a non-stop train was run from Carlisle to Glasgow in 2 hr. 20 min.

[Reply to ALEX. W. ANDERSON.]

Metropolitan Railway Goods Trains.

Goods trains to and from Farringdon Street depôt are worked by electric locomotives.

[Reply to "M.E.T."]

West Coast Service to Edinburgh.

We have no information as to the prospective acceleration of this service.

[Reply to "PAIGNTON."]

Queen Street Station, Cardiff.

Taff Vale, Cardiff (Queen Street) Station was opened in the year 1887.

[Reply to E. L. A.]

Southend Line, Great Eastern Railway.

This branch is signalled in the ordinary way.

[Reply to "SOUTHERN BELLE."]

"R. & S.B.R."

Indicates Rhondda and Swansea Bay Railway. See RAILWAY YEAR BOOK, page 276.

[Reply to A. R. HARRISON.]

Improvements at Newport, Great Western Railway.

No details of the alterations and additions to be made can yet be given.

[Reply to L. DICKS.]

Great Eastern and Great Northern Joint Railway.

Obviously the reply recently given should have been headed as above.

[Further reply to P. A. S. HADLEY.]

Great Central Railway "Atlantic," No. 1090.

This is still a three-cylinder simple engine.

[Reply to B. A. BIGGS.]

"Twentieth Century Limited."

This train of the New York Central Railroad is still running.

[Reply to D. WHITTAKER.]

Peterborough.

No locomotive building is carried on here.

[Reply to R. H. H.]

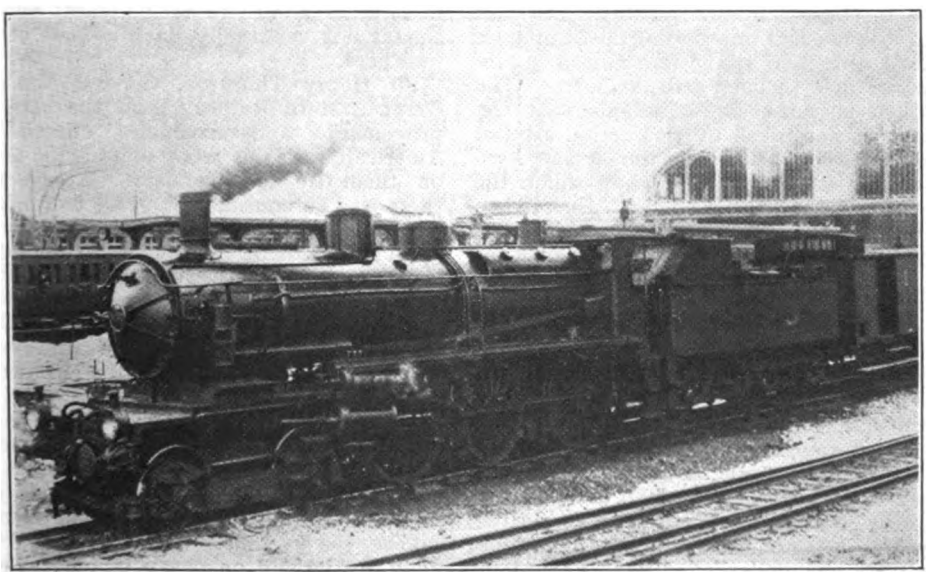

Photo.] NORTHERN RAILWAY OF FRANCE. [*W. H. C. Kelland.*

4-6-0 Compound Superheater Locomotive, No. 3.620, at Arras.

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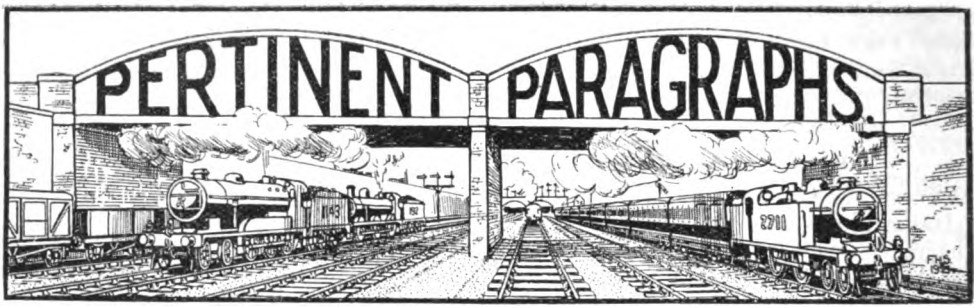

The Future of British Railways.

At the December meeting of the Institute of Transport a paper was read by Sir George Paish on "The Future of British Railways," in which it was pointed out that in the past the growth of British railway expenditure—both revenue and capital—kept pace with the growth of traffic, and the return on capital was fairly constant. But now revenue expenditure is nearly as great as income. The proportion of expenses to gross earnings in 1913 was 64 per cent., in 1919 it reached 94 per cent., and in 1920 it was no less than 98 per cent., while an expansion of 97 per cent. in receipts was attended by an increase of 200 per cent. in expenses. Experience since the last advance in rates and fares shows that the remedy lies not in increased charges to the public, but by increased efficiency of management and by real economy in operation. The realisation of this fact is so general that there was no serious opposition to the proposal to consolidate the railways into four great systems and thus permit the companies to deal with their traffic in a more comprehensive and economical manner. The problem is, however, so serious that the economies permitted by this action are not likely to be enough to meet the increased expenses for wages in a period in which the volume of traffic would be low. Even when the cost of living has fallen by 100 points and the rate of wages reduced by £1 per week the burden of increased wages will still be very heavy. Substantially over 50 per cent. of railway expenditure is upon wages. The idea that increased railway wages can be paid by higher railway charges must be abandoned. Labour must be rendered more valuable by labour-aiding appliances and better methods. Increased wages are possible only as the efficiency of labour increases and more economical methods of operation are adopted. Railway workers of all grades were entitled to higher rates of remuneration than before prevailing they cannot get these higher rates of remuneration out of the public by higher rates and fares. Railway staffs, in common with the workers in other industries, will discover that war did not bring with it less work and higher wages, but more work and lower wages, that war created poverty and not wealth, and that instead of rewards it demanded sacrifices.

A 260-ton Average Train Load.

In opening the discussion, Sir William Acworth said that he thought too much was being made of facilities and too little of rates, and that the public, if put to the choice, would be willing to accept a reduction of facilities which would enable substantial reductions to be made in rates and fares. Methods that were perfectly reasonable before the war had now to be looked at with the expectation that they might be wrong methods to-day. The average American train load was 750 tons, and the corresponding British figure was 132 tons. The Americans had quadrupled their load in 40 years, and there was no reason why we should not eventually have a load of 260 tons here.

Sir Henry Thornton, General Manager, Great Eastern Railway, said that the improvements and economies effected on American railways were practically forced on them by circumstances. About 1890 there was an enormous impetus to business. American railway managers found themselves short of locomotives and were forced to build very much larger cars and locomotives of very much greater tractive power to cope with these great blocks of traffic. In Great Britain there were no blocks of traffic corresponding in capacity to the ironworks, bituminous coal and grain traffics of the United States. He did not think we should even approach the truck and locomotive capacity or the train load of America, but there was an opportunity for economy on those lines, and the load might be raised to 260 or even 300 tons. Our railways had been built under labour and by very expensive. Conditions had now become here

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very like those in America, and in order to effect economies we should have to adopt labour-aiding devices so that a smaller number of men might be employed at a higher rate of pay. The only systems at all comparable to our new groups were those in the United States, which were an evolution. Here we had to produce almost over night what it had taken 40 years to bring about in America.

Sir John Aspinall, late General Manager, Lancashire and Yorkshire Railway, discussing the importance of the new groups, pointed out that the North Western, Midland and West Scottish group had about 20,000 miles of single track, 541 millions of capital and well over 250,000 employees. He feared there would be disappointment about some of the economies expected, as considerable economies had already been effected by existing pooling arrangements, and having been created these economies could not be created again. There was, however, one source of economy. Some 614,000 of the 1,300,000 wagons is use on British railways belonged to private owners, and he calculated that the shunting of those private owners' wagons required, in 1920, some 59,000,000 shunting miles. At the present time the number of traders' wagons was some 132,000 below the normal output, and now would be a good opportunity to exercise the power of prescribing the type and capacity of new wagons for export coal which was given by Section 13 of the Ministry of Transport Act, 1919.

Further Railway Concessions.

ONE by one pre-war facilities and concessions are being restored, and among those recently granted are the reductions in rates for coal and certain other commodities which, while not great, have a definite value and pave the way for further reductions as they become practicable, and the reversion by English and Welsh railways to the free periods allowed in pre-war days for the loading and unloading of wagons and use of sheets used in the conveyance of merchandise other than coal, coke or patent fuel. This arrangement is a temporary measure operating from January 1, 1922, for twelve months, when the question will be again reviewed. The existing demurrage regulations have been in force since January 1, 1920, and were imposed by the Ministry of Transport when, owing to the war, there was a great shortage in rolling-stock. It is estimated that this concession will relieve traders of charges for demurrage, representing about one million at north-east coast and Humber ports were made, South Wales ports having already introduced lower charges; while at Southampton and other ports reductions are also announced.

On the passenger side the railway companies intimate the reinstatement of tourist tickets and a reduction in the price of market tickets. The tourist ticket facilities are to be restored for the next holiday season, and there can be little doubt that this concession will be appreciated very highly by the travelling public, who used the tickets extensively in the old days. While these tickets, which are to be available for two months, do not offer much in the way of a reduction in fare, they afford facilities, such as permission to break the journey and long-date availability, that render them exceedingly popular. The reduction on market tickets is from 1½ times the ordinary single fare to 1⅓, a feature that should stimulate the use of such tickets. They are issued on certain days of the week from and to authorised stations, and, especially in the provinces, are used on an extensive basis. These concessions indicate clearly that the railway companies are anxious to meet the requirements of the public as far as practically possible, and it is likely that there will soon be other developments towards that end.

Sleeping Cars in Germany.

COMMENTING upon reference in the November RAILWAY MAGAZINE to sleeping cars on German railways, Mr. W. J. Bassett-Lowke sends some interesting particulars based upon recent travelling experiences. He points out that the German State railways in pre-war days ran, within their own borders, sleeping cars of a very similar construction to those of the International Sleeping Car Company, but of a slightly better design and fitted with electric light instead of gas. Each compartment contained an upper and a lower berth, and when both berths were occupied, second-class tickets were accepted, and a charge of from 5s. to 8s. per journey was made. If the passenger required a compartment to himself he had to pay first-class fare, the same as in England, plus the same addition for sleeping berth. Second-class fare in Germany, in pre-war days, was practically the same price as third-class fare in England. Comparing these with the International Sleeping Car Company's charges, Mr. Bassett-Lowke sends a personal experience:—"I was in Nurnberg in September and wanted to return by the Vienna-Ostend express, which leaves Nurnberg about 7 o'clock at night. I paid for a berth on the International Car plus first-class fare. My friends had two berths on the State railway car, which

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joined us at Wurtzburg, but, of course, owing to the Peace Treaty, it cannot run further than Aachen. The cost of those berths was 6s. 6d. each, plus second-class fare. In both cases, I have calculated the rate of Exchange at about 240 marks to £1, which was about the rate at that time."

Beware of Pickpockets.

WRITING in reminiscent mood, Mr. W. Harris, late of the Metropolitan Railway police department, calls to mind some of the methods of the pocket-picking fraternity of which he became cognisant in the course of his duties. On one occasion a gentleman was ascending the exit stairs of a busy station. Suddenly there was a great commotion owing to someone in front of him dropping a lot of coppers, which toppled down one stair to another. This attracted his attention, and the men picking up the money blocked his progress. He did not feel any unusual pressure about his pockets but on going to show his season ticket at the barrier he found it and a case with £40 in notes had been stolen. A railway detective recently witnessed a scene similar to the above and at once realised what the game was. He caught hold of one man who had done sufficient to justify arrest, when he was surrounded by seven others who hustled and tripped him and then, in the confusion, got away. The detective could only get away with assistance, as he had sustained a kick on his shin which caused him pain for several weeks.

Mr. Harris records an experience of his own at a London station. He saw three men whom he had reason to suspect, so he watched. A lady, with other passengers, was about to enter a carriage; the three men, who had been walking some distance apart, as if they did not know each other, suddenly surrounded the door and tried to get at the lady's pocket. They evidently failed for they dispersed and got into different compartments of the then moving train. At the next two stations they alighted and repeated their tactics, but their luck appeared to be out, and they again entered the train, and, as it was running out, the writer just had time to ask the inspector to 'phone the next station for police, and on the three suspects alighting he gave them into custody for attempting to pick pockets. They vowed their innocence and threatened all kinds of pains and penalties, but they were committed for trial. They were found guilty and sentenced to nine months' imprisonment, but their counsel then raised a point of law that as none of the people [illegible] even been spoken to, it had not been proved that there was anything in the pockets to pick; therefore they should not have been convicted. The point was referred to the Court of Appeal and on it being heard the conviction was upheld, but it was then found that in the interval, while out on bail, two of the prisoners had absconded, whilst the third was doing six months in prison for another offence.

Is the Railway Company responsible?

"IT has always been a nice point," comments Mr. Harris, "as to *who* should accept the responsibility of giving these offenders on private property into custody. The complainants generally decline to do so, especially if they have not lost anything, so that in the case of a railway company the anxiety and expense of a trial is thrown upon them. Of course it is a satisfaction, if the result ends in a conviction, to know the gang will be under lock and key for a certain period, but the idea that the railway will be freed of the pests for that time does not materialise, as no sooner is one lot got rid of than up comes another. I have always held that, as a railway company only contracts to *carry* passengers with *reasonable care*, the onus of protecting their *personal* belongings should rest upon the passenger. Two remarkable facts stand out in connection with this class of crime, viz.: (1) the thieves invariably manage to get a valuable haul either in the shape of a presentation watch, a diamond pin or a bag of notes; and (2) prison does not seem to have any terror to or reforming influence upon the criminals, for no sooner are they out than they return to their 'profession' and are in again. During the late war some of them took advantage of their seven days' leave to 'carry on,' with the result that they appeared in a police court dock in the hope that they might be sent to prison rather than back to where the fighting was."

The Fascination of Railway Frauds.

CHANGING his theme, Mr. Harris refers to the fact that although penalties and publicity are intended to act as a deterrent, travel frauds on railway companies are much more prevalent now than they were 50 years ago. "There is a class of people whose standard of morality, in a general sense, is so high that they would as soon think of cutting off their right hand as of putting it into another person's pocket to steal, yet, when the opportunity presents itself to steal a portion of a fare from a railway company, this standard sinks to that of the one afternoon, 50 years ago, when about

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twenty persons of both sexes were summoned for defrauding a railway company. Their *modus operandi* was to take a penny ticket at their starting station in order to get access to the platform, and then, on reaching their destination, paying the collector another penny and saying that they had come from the preceding station. The fact that some hundreds of these starting station tickets never came into collection caused the officials 'seriously to think,' and the upshot was that for two days quite an army of ticket collectors (in plain clothes) kept observation, following everyone who took a penny ticket, to see if they alighted at the end of that fare or proceeded further on. Of course some got out at their station, but in two days there was a catch of twenty wrong ones. These were fined (generally) 40s. and costs, the magistrate remarking that offenders would find the game 'penny wise but pounds foolish.' It afterwards became known as 'the penny ticket dodge.'

"Forty years ago a certain military man of high rank was noticed taking a third-class three-halfpenny ticket every morning, and, when a train came in, deliberately making for a first-class compartment, and passing out without paying any excess. After being shadowed on eight different occasions, in order to show his conduct was systematic, and not accidental, he was stopped, and, after some difficulty, his name and address was obtained and he was summoned and heavily fined. I have mentioned that the gentleman's name and address was obtained *after some difficulty*. When he was asked by the official, who was in plain clothes but explained who he was, he pooh-poohed the idea and walked on. The official followed and when the offender saw this he entered a church, the door of which was open. It was 4.0 p.m. The official was about to follow when the vicar appeared and barred him, saying that it was a women's service that was being held. The official explained that a gentleman had just entered whose name and address was wanted for a railway offence, but the vicar was obdurate and would not let him pass. The official intimated that he should wait there until the gentleman came out, and then the vicar said 'it's no use doing that for he has left by a door at the other end.' Fortunately the official knew where to pick his quarry up again, and, at the hearing of the summons the railway counsel stigmatised the offender's conduct, in seeking protection under the cloak of religion, as despicable."

DEMOUNTABLE FLAT IN POSITION ON STAND-DRAY, LONDON & SOUTH WESTERN RAILWAY.

Demountable Flats.

LOADING and unloading consignments of goods on railways and road motor vehicles

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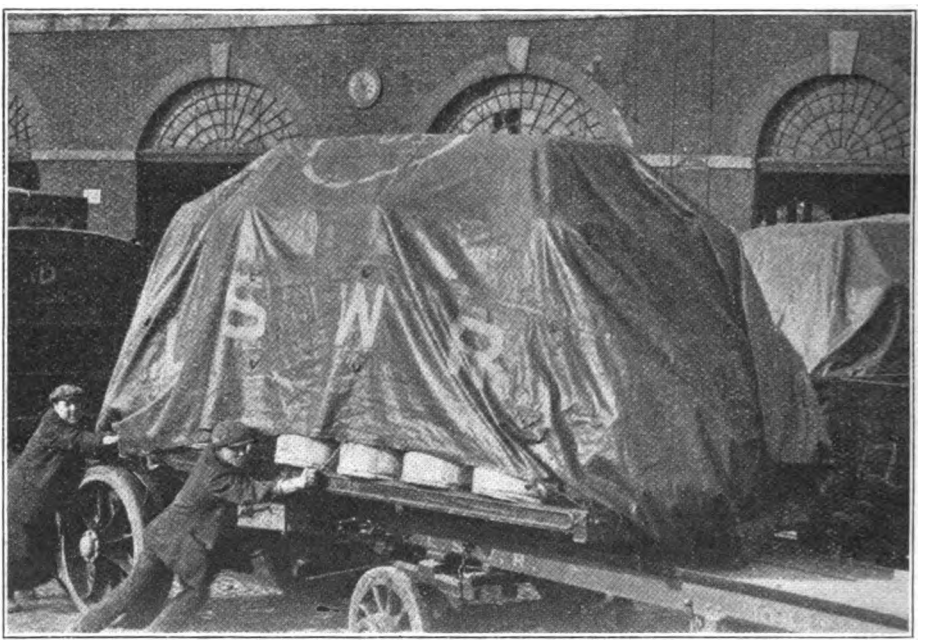
by means of what are known as demountable flats, which make it possible to transfer a load from one to the other or *vice versa* in a few minutes, has been dealt with previously in these columns. The principal advantages are saving in time and labour, and the system, which is capable of considerable extension, is finding favour on several railways. It has recently been adopted by the London and South Western Railway with great advantage and two illustrations are reproduced showing the arrangements employed.

The old method of collecting goods was to despatch a pair-horse van with two men at 9 a.m. each day to pick up a load. The horses and men were compulsorily kept idle while the goods were loaded piecemeal, the van eventually returning to the goods yard with its load and frequently being unable to perform more than one return journey in the day. Under the new arrangement a motor lorry leaves the depôt at 9 a.m. with an empty demountable flat to pick up a load. Upon arrival the flat is pushed or lifted off the chassis and a loaded one transferred thereto by similar means. The lorry is able to return with this load at 10 a.m., the load being then transferred to the stand-dray, after which the motor sets out again on another trip at about 10.15 a.m., carrying an empty flat as before. Horses are harnessed to the stand-dray to which the first load was, as stated, transferred and haul it to the goods siding ready to load it on to a wagon of the goods train. By this means loads collected late in the afternoon can be delivered at far distant points early the following day per goods train. Also six return journeys can be accomplished in a day, whereas previously this might necessitate the employment of twelve men and six pairs of horses. The inward traffic or goods delivery is conducted on the same lines and with the same saving of time and labour. The wheels of the demountable flats illustrated are fitted with self-aligning ball bearings, which considerably facilitate the ease of handling of the flats, especially in their loaded condition.



TWO MEN TRANSFERRING A LOAD OF 50 BARRELS OF APPLES (WEIGHT, 4 TONS), LONDON & SOUTH WESTERN RAILWAY.

2-6-0 Locomotives and High Speed.

THE notion that large diameter coupled wheels are essential for high speed has long since been dispelled, but it is even now not generally realised that engines of all classes not infrequently travel at speeds higher than those for which they are nominally intended. This condition is, in fact, taken into account in their design, so that goods engines or suburban tank engines can, on occasions, run quite safely at speeds of 60 m.p.h. or even more. And in the case of modern mixed traffic 2-6-0

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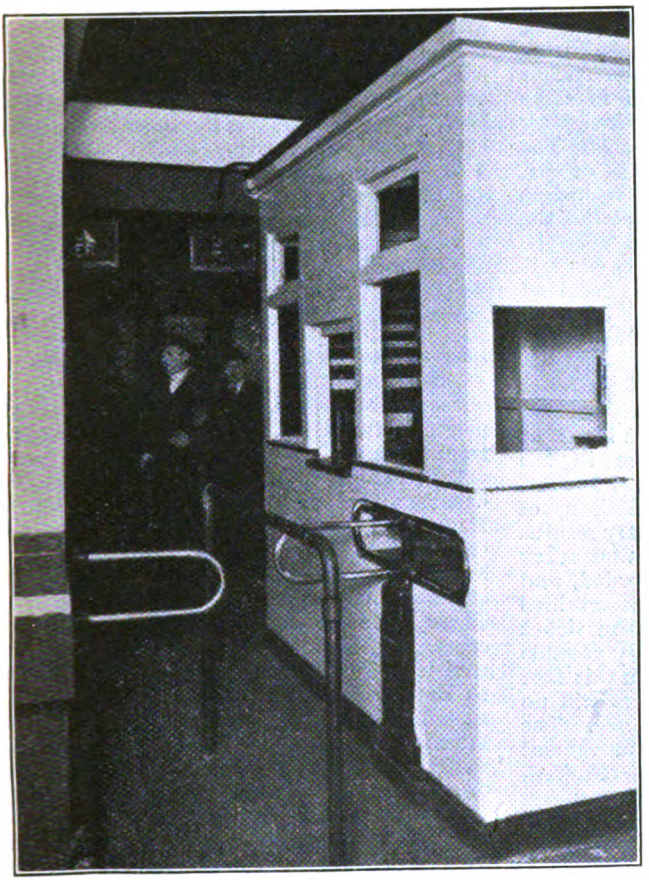

"PASSIMETER" KIOSK AT KILBURN PARK STATION, LONDON ELECTRIC RAILWAY.

locomotives with 5 ft. 8 in. coupled wheels there is nothing exceptional in their running at speeds of 70 m.p.h. or faster. These remarks are prompted by a letter from Mr. E. Little, on the basis of Mr. Chas. S. Lake's recent article describing the work of Great Northern Railway "1000" class engines on heavy main line express trains during the 1921 coal strike. It is, however, pointed out by the author that the references to high speed were designed to indicate that these engines could run quite smoothly at high speed on favourable sections of line, no suggestion being made that it is good practice to run engines of this class regularly at such speeds. As the wheels are only of moderate diameter, the working parts are naturally given a more severe test when running at speeds which are normal for locomotives having larger wheels, and it is only to be expected that enginemen prefer to run as far as possible under conditions which are most suitable for their engines. Sixty to sixty-five m.p.h. is about the maximum which should be attained by such engines, the fact that they can safely and smoothly go beyond this is rather a credit to the design than an argument for their being run at such speeds as a regular practice.

The Passimeter.

In order to expedite and facilitate passenger booking and ticket examination, "Passimeter" apparatus has been experimentally installed at Kilburn Park Station on the Bakerloo section of the London Electric Railway. The object is to combine ticket issue and examination at one point, whereas in the ordinary way there are at least two points of congestion, one at the booking windows, or even at the automatic ticket machines, and the other in passing the ticket examiner to proceed to the trains by means of stairways, escalators or lifts. According to the new system every passenger requires to pass through the "passimeter," but this operation is combined with the issue of tickets, the booking clerk being required to pass everyone through, either on purchase of a ticket or on showing a season or return ticket. There is, in effect, the substitution of one "bottleneck" instead of two as occurs during busy periods at so many "Underground" stations, one at the booking window and the other in passing the ticket examiner. This, in practice, is a very important factor from which valuable results are expected to follow, as the conflicting streams of passenger movement in and about the booking hall are eliminated, everyone being directed to one or more parallel streams.

Equipment at Kilburn Park.

As installed at Kilburn Park, there are three "passimeter" controlled passage-ways. At times when traffic is light one only need be employed, the booking clerk issuing tickets with the aid of the "automaticket" apparatus or passing ticket holders. During the rush periods a second equipment can be brought into use, together with a separate passage for the use of ticket holders who require only to pass through and do not purchase tickets. Should, however, a passenger not follow directions correctly, the ticket issuing clerk can pass a ticket-

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holding passenger through without turning him back. There is also a side passage which can be used for exit purposes during the quieter periods. A separate ticket collector is still required, though in some instances the booking clerk can also look after this work from a window on the opposite side of his kiosk. When there is a rush of exit traffic, however, another exit is opened leading direct into the street, and at this the ticket collector or collectors will then be stationed.

The design of the equipment has received special attention, and includes several features of interest. Passimeters are fitted with ball bearings and are of light construction so as to work easily. They are somewhat similar to those used on the Brooklyn Rapid Transit Railway in New York, and it was at first intended to purchase them in the United States. The work has, however, been carried out by Messrs. Ellison, of Manchester, with entirely satisfactory results. Counting mechanism is fitted, so that every passenger passing through is recorded, and this will enable exact figures to be ascertained as to the journeys made by season ticket holders, as to which it has been only possible hitherto to adopt estimates. From this fact some interesting and useful figures will no doubt become available in due course. The passimeters permit of backward movement and then do not register, and, if required, and at periods of light traffic, passengers can pass out that way instead of by a separate exit, and the booking clerk can then, if need be, act also as collector. It is not, however, anticipated that the apparatus will be used to any appreciable extent, if at all, to dispense with ticket collectors, expecially on the London "Underground" lines. On issuing a ticket or noting that a passenger holds a correct ticket, the booking clerk releases the passimeter by light treadle mechanism, which mechanism will shortly be worked electrically, at the same time operating the cyclometer or counter.

"Automaticket" Apparatus also used.

THE "automaticket" apparatus provides for the issue of standard fare tickets singly or in multiple, the booking clerk pressing buttons so that for each fare the machine ejects in one strip from one to five tickets, of the particular value. These are dated and appear in a cancelled form. It is necessary, however, to provide for the issue of other tickets, and, after much experiment, a satisfactory machine has been produced by which such tickets can be dated and punched for cancellation simultaneously, at the same time being enumerated so that full records of the numbers of tickets of all kinds issued and of every passenger passing through can be secured.

A special feature of the kiosks erected for use with "passimeter" equipment is the attention which has been given to details, even to such matters as the most convenient height and width of the counter, the ledger desk, and the placing of the various appliances. The kiosks are glazed all round, and to avoid any loss of light the ticket cases are transparent and combine with the glazed work of the structure. A special cash register is provided to enable the operator to record excess fares.

Locomotive and Train Working, Furness Railway.

IN regard to Mr. Ahrons' recently completed articles Mr. R. G. Lindsay writes from Belfast:—

"In dealing with the through trains or carriages to Barrow, Piel Pier and Barrow Ramsden Dock in connection with the Isle of Man boats, Mr. Ahrons has either overlooked or ignored the daily services of steamers that ran to and from Belfast. These steamers at first plyed from Morecambe, and then in the early 'seventies were transferred to Piel Pier, and some years later to Barrow Ramsden Dock. The inauguration of the Midland Company's route from Heysham brought down the service to a bi-weekly one, which ceased when the war broke out, and has not been resumed since. In connection with the Piel Pier and Ramsden Dock sailings the boat trains proper were furnished by the Midland Railway. Leeds being the starting and terminal point. Passengers for the Whitehaven Line departed from Barrow Central Station, those for the Lake District travelling in the boat train to Ulverston, where they changed, continuing in a Furness train to Lakeside. What the winding-up of the Belfast-Barrow service meant to the Furness Railway I am unable to say. It was a most convenient route to Whitehaven, and in particular to the Lakes via Lakeside, Windermere. It was also possible to reach fairly comfortably Darlington, Durham and districts via Carnforth and Tebay. The Isle of Man service mentioned by Mr. Ahrons (summer-time only) was of small importance compared with the all the year round nightly sailings to and from Belfast."

To this letter Mr. Ahrons replies: "Mr. Lindsay is quite correct; it would have been better had I mentioned the Belfast steamer service. I had in mind, however, only train services, hence the omission. I did mention that the boat train carriages were provided by the Midland Railway, not only from Leeds, but at one time from Bradford as well, though the latter were discontinued

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for a time at one period. For many years the boat train left Leeds at 3.35 p.m., and picked up the Bradford carriages at Shipley by backing on to them at Bingley Junction signal box. I was a frequent traveller by this train."

Mr. Ernest Benedict.

A PUPIL of Brunel, whom he assisted at the launch of the *Great Eastern* steamship more than sixty years ago, for many years engaged in railway construction in India, and still regarded as an authority on railway civil engineering and on Indian matters, Mr. Ernest Benedict, the eldest and only surviving son of the late Sir Julius Benedict, has, at the advanced age of 83 years, become practically blind and unable to continue earning his livelihood as he has done for many years past, by contributing to railway and engineering journals on technical subjects. Unfortunately, although a singularly capable engineer, Mr. Benedict was neither a business man nor an investor, and now that he is unable to continue his work a number of his friends have formed a committee and established a fund under the Presidency of Sir Guilford Molesworth, K.C.I.E., Past President Inst.C.E., the Nestor of Civil Engineers. Mr. Worby Beaumont, M.Inst.C.E., has consented to act as Hon. Treasurer and would gratefully acknowledge subscriptions addressed to him at the Outer Temple, 222, Strand, London, W.C. 2. Further information will be furnished gladly by the Hon. Secretary, Mr. Wm. Yorath Lewis, A.M.I.Mech.E., A.M.I.E.E., The Clock House, Arundel Street, Strand, W.C.2.

Locomotive and Train Working, London and South Western Railway.

ARISING out of Mr. Ahrons' articles dealing with the older locomotives of the London and South Western Railway, Mr. L. E. Fletcher mentions that the author, in replying to a query, stated that Beattie 0-6-0 goods engines Nos. 229 and 231 were built in 1878, though according to his own information Nos. 221–226 and 231–236 were constructed in 1866. To this Mr. Ahrons replies that the original engines, Nos. 227 and 228 were 2-4-0 outside cylinder passenger tender engines with 6 ft. wheels and 16 in. by 22 in. cylinders, while Nos. 229-230 were 0-6-0 goods tender engines with 5 ft. wheels and 16 in. by 24 in. cylinders. All four were built by Messrs. Stephenson in 1866, but as they were not of Mr. Beattie's London and South Western standard types they were put into the duplicate list and superseded by new engines in 1877–8.

Mr. Fletcher also asks in reference to an engine numbered 392 and named *Lady Portsmouth*. This engine, writes Mr. Ahrons, was a small contractors' saddle-tank locomotive built in 1862 by Manning, Wardle & Co. It had 3 ft. wheels and 12 in. by 18 in. cylinders, and came into the possession of the London and South Western Railway about 1880. It is suggested by Mr. Fletcher that Beattie goods 0-6-0 engines Nos. 273A and 277A, which have recently appeared at Strawberry Hill depôt are the oldest now at work on the London and South Western Railway.

Pilgrim Traffic in India.

THE REV. W. MACHIN, of Lucknow, India, writes: On the Oudh and Rohilkhand Railway recent advances have been made in the way of providing special facilities for the pilgrim traffic. On the lines of this railway are to be found three great places of pilgrimage: Ajodhya, the birth-place of the hero-god Ram; Benares, the centre of all that is most sacred in Hinduism; and Prayag (part of Allahabad) where the sacred rivers, Ganges and Jumna, meet. The ordinary trains have been, during the war, when special trains were impossible, overcrowded by pilgrims. Now, however, a regular service of trains has been put on, running at night, so as to afford the daytime for the religious purposes of the pilgrims. Three trains run, so that there is a train each day from each place of pilgrimage to the next. If we take a Yatra (pilgrimage) train going from Moglial Sarai, where the line joins the East Indian Railway, it goes the first night through Benares to Prayag Ghat, close to Allahabad; the next night to Ajodhya Ghat, both of these stations only being used for pilgrim traffic. The third night it proceeds to Moghal Sarai, via Benares. Passengers from the South-east, of whom there are very many, can visit Benares either on the journey up or down. It is to be hoped that this arrangement will reduce the over-crowding of the third-class compartments of the ordinary trains, which has been very bad for a long time past.

Early "Stoneways" Still Existing.

WITH reference to paragraphs in recent issues of the RAILWAY MAGAZINE concerning the stoneways on the road near Weedon, Mr. J. G. Irving writes that in the 1913 volume of the *Locomotive Magazine* the question of the origin of these was raised and after some correspondence had passed a letter appeared in the November issue of that year quoting an extract from the *Northampton Mercury* of October 23, 1886, as follows:—

"The rough stone tramway along the Watling Street between Towcester and Weedon, was done in the year 1837. The two hills were cut through at the top of each

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and the earth carted into the hollow, where there is a brook and a bridge over it called Gun Bridge. A new and stronger bridge was built in the same year to carry the earth brought there from the hills, so as to make the road as level as could possibly be done. On the left, or near side of each hill was then laid the present tram road. Some of the large centre stones over which the wheels run were brought from Mount Sorrel, and a great many are Scotch granite from Aberdeen. They were laid by Mr. Edwards, of Heyford, and the whole of the curb stones were laid by Mr. Thomas Bishop, of Fosters Booth, assisted by Mr. Thomas Reeve, of Cold Higham, both of whom are still living there, and I may say that the work is as good now as it was then. The work was carried out by the then Turnpike Commissioners, in order to enable the coaches to compete with the railway then being made from Denbigh Hall, near Bletchley, to Rugby, which railway opened for traffic either just before or at the time the tram road was completed. How far it answered in such competition I must leave the reader to judge. About 300 men were employed in this work under the superintendence of Mr. Geo. Savage, now of Stoke Bruerne, who had the entire management of the whole work, under Mr. John Judkins, of Heyford, the surveyor to the Commissioners.

" [The above informaton was supplied to the *Mercury* by Mr. D. Norman, of Towcester, and he knew all the persons named.—H.W.] "

Mr. Irving mentions that he has frequently cycled over this road and has noted the stoneways were still there. The last time was in September, 1919, when travelling from Manchester to London per motor cycle. He also sends a photograph taken in 1905, *en route* from Scotland to London, which is now reproduced.

Photo.] [*J. G. Irving.*

STONEWAY ON WATLING STREET, NEAR WEEDON.

Switching-out Single Line Electric Train Staff Station.

THE process of " switching-out " signal cabins, whereby signalmen can be dispensed with at points where traffic is relatively infrequent and the longer sections can be conveniently operated, is usual on double lines ; but on single lines it presents difficulties in that it upsets the staff or train tablet arrangements. There are, however, sections where, on Sundays, and sometimes at other times, there is no real necessity for all staff or tablet cabins to be open, especially at intermediate crossing places, and at stations which are not opened ; or where by the use of conductor guards or other arrangements there would otherwise be no need to bring signalmen on duty. To overcome this difficulty an ingenious arrangement is being introduced on sections of the London and North Western Railway, devised by Mr. J. T. Roberts, Signal Superintendent, and his assistant, Mr. P. W. Hardman, in conjunction with the Railway Signal Company, Limited.

Broadly, the principle is that a superior staff is used for the composite section, but this cannot be obtained until an ordinary staff

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has been withdrawn from each of the intermediate instruments, after all sections are clear of trains. The staffs thus withdrawn, each signalman dealing only with a staff for a given direction where he has single line sections on either side, are required to enable a drawer in the instrument to be closed, and until this is done by every man, the independent circuit for the composite staff section is not completed, and when that is in use the intermediate staffs are locked in the drawer. For switching out there is no need for the intermediate signalman to work in ordered sequence ; but for switching in it is necessary for the signalman to proceed in order, the first being able to obtain his intermediate staff when all the long section staffs are replaced, and being then able to authorise and release the adjoining signalman's intermediate staff. This process can, however, be conducted from either end.

Early Railways amalgamated with the Great Western Railway.

Mr. D. D. Rowlands, of Llanelly, suggests that we were in error in stating in reply to "E. L. A." in the November number that the Llanelly Railway was amalgamated with the Great Western Railway as from July 24, 1889, and mentions January 1, 1873, as the alternative date. "Bradshaw's Manual," however, shows that the Llanelly Company was still in existence in 1889, thus showing that the earlier date cannot be correct. The line was worked by the Great Western Railway from 1873 and Mr. Rowlands is probably correct in stating that when he worked in the offices of the Llanelly Company from 1879 to 1889, Great Western Railway letter paper, &c., only was employed. The same would apply to the staff register, which became Great Western Railway in 1884. Apparently the line was taken over by the Great Western Railway for working on agreed terms in 1873, but the company remained in existence until 1889.

Other railways in South Wales amalgamated with the Great Western Railway include the following:—July, 1881, Monmouthshire Valleys Railway and Canal Company (now Eastern and Western Valleys Branches) ; August, 1881, Carmarthen and Cardigan (Carmarthen to Pencader Junction wtih a branch to Newcastle-Emlyn) ; September 1, 1886, Whitland and Cardigan ; July 1, 1896, Pembroke and Tenby (Pembroke Dock to Whitland with the curved spur line east of Carmarthen Junction swing bridge over the river Towy, thence turning northwards into the former old station at Carmarthen, now demolished) ; July 1, 1906, Manchester and Milford (from Pencader Junction northwards to Aberystwyth).

The Leamington and Coventry Section, London and North Western Railway.

FOLLOWING upon previous paragraphs, Mr. G. W. Bishop, writes :—" The history of this line was dealt with in the RAILWAY MAGAZINE November, 1917. For many years the Leamington Station was known as Leamington (Avenue), probably from the Avenue Road, where it stands. It was sufficient to use the word 'Avenue' at local booking offices. Later, both London and North Western Railway and Great Western Railway adopted the name 'Leamington Spa,' the stations and signal-boxes being lettered accordingly. When motor trains were introduced on the Rugby and Daventry branches a change was necessarily produced at Leamington. Formerly engines and trains could work from Rugby and on to Coventry or Birmingham, and *vice versa*. Now, Leamington is practically a terminus for the latter traffic, but owing to the main line being often required for the motor-trains many down trains have to start from the bay line, which is inconvenient in wet weather. The motor-trains work to and from the Warwick (Milverton) station near by. This station has very long platforms, due to a newer station having been added to the old one, the older buildings being used for offices. A fair number of modern engines are now to be found at the shed (No. 11). There are four regular turns with big express engines, the up morning mail, the 8 a.m. to Crewe, an up evening local from Birmingham, and the down evening mail. 'Precursors' are also sometimes seen on locals. The eight-coupled mineral engines are much in evidence on coal trains from Coventry to the Great Western Railway and the South, and on the corresponding empty wagon trains from Leamington. One or two shunting 0-6-0 tanks are kept for shunting at the shed, and at Leamington coal sidings. Kenilworth platforms have been raised to modern height and a season-ticket holders' entrance installed on the up side. The down advance starting signal post has a fixed distant arm referring to Kenilworth Junction, the former two-armed distant signal having been removed. The direct Berkswell line now has two down and two up trains daily. At one time the Kenilworth end of this line was often used as a refuge for coal and empty wagon trains waiting their turn to proceed. Now that the loop at Gibbett Hill is in use trains can wait there instead. (This box owes its sinister name to an ancient gibbet that used to exist at the cross roads near by.) Many local efforts have been made to get the remaining length of single line doubled. The company appear to consider that the expense would be too great, as there is a deep

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cutting and a long stone viaduct to be considered. Local trains used to be lettered 'Leicester, Leamington, Nuneaton and Rugby,' but are now 'Leicester and Leamington,' including one or two from the North London Railway painted in London and North Western colours, which look very neat. In pre-war days Midland coaches and brake vans worked to Leamington, but have not yet reappeared. For the first time in many years the Sunday train service has been increased (from October 9), probably to compete with the motor 'buses."

A Historic Articulated 0-6-6 Tank Engine.

MR. A. CURRAN, of Newton Center, Mass., U.S.A., sends a photograph of an old American 0–6–6 tank engine possessing several noteworthy features, apart from its historic interest. This engine, the *Leviathan*, of the Utica, Ithaca & Elmira Railroad, was built by the Mason Machine Works of Taunton, Mass. "This engine—which was what Mr. William Mason called a 'bogie'—was completed 1st February, 1875, works No. 547, and had 17 in. by 24 in. cylinders, 42 in. drivers, and weight on drivers of 33 tons. (Total not given.) The *Leviathan* was a tank engine of the type which we should now designate as 0–6–6, but had swivel drivers. Mason appears to have drawn his inspiration from Fairlie. and to have realised some of the advantages of Walschaert's gear at an early date. He built a number of these 'bogies' for various lines, and tried hard to make them popular. A certain unsteadiness of motion even at moderate speeds, however, tended to discourage their extensive use. A peculiarity of the *Leviathan* (and of certain other 'bogies') was the position of the dome, this being located on the gusset ring of the boiler. This was not regarded as good practice over here."

0-6-6 TANK ENGINE "LEVIATHAN," UTICA, ITHACA AND ELMIRA RAILROAD.

Inter-Railway Comparisons.

A WIMBLEDON reader reports a conversation he overhead at Paddington station between two people who, as the 1.5 p.m. West of England excursion train was loading up, compared opinions, the one eulogising the Great Western Railway Company for the fine rolling-stock and high speed schedules even of the excursion trains, the other upholding the South Eastern and Chatham Railway. Our correspondent is rather "down" on the latter, suggesting that on the South Eastern and Chatham Railway the best engine performances and the best rolling-stock are reserved for the Continental boat expresses and a few special trains such as those on which Pullman cars are run, and instancing the new Sunday "Thanet Pullman Limited." The truth is that the two railways cannot be compared, so essentially different are their principal traffics, while the locomotives, rolling-stock and operating conditions are adapted to the respective lines and are in no sense equivalent.

As a long distance line the Great Western Railway requires to operate its trains at high speed, has a large supply of vehicles

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of convenient size and of up-to-date construction and design, and is provided with locomotives of great size and power. High speed schedules are further facilitated by the favourable grading of most of the main routes, and while the highest credit must be given to the company for its enterprise and for the progressive attitude evidenced in every department for many years past, it is but fair to emphasize the many factors which have rendered this the desirable and correct policy, and in view of which permanent-way improvements, large and powerful locomotives, and essentially modern rolling-stock have enabled the high standards of to-day to be reached.

On the South Eastern and Chatham Railway, however, the system is complicated by interworking train services in all directions, which render it difficult to find high speed paths for trains; the gradients are usually unfavourable and relatively very steep at that; high speed can rarely be maintained for any considerable distance. Even the most powerful locomotives are still comparatively small and the more advanced types cannot be used, and the rolling-stock, mostly engaged on journeys of moderate length only, is required to serve many purposes, only a few sets being definitely reserved for special duties. The relatively short distances covered even by the principal non-stop trains render it unnecessary to raise average running speeds to a very high level, as the increase would, at most, save only a few minutes on a complete run, were that practicable in view of the traffic and engineering difficulties. In practice, as Mr. Cecil J. Allen has shown these "small" engines frequently put up very fine performances, and the work entailed is often very much more meritorious than it appears to be on paper.

A Three-coach Express on the London & North Western Railway.

Reproduction on page 18 of the January RAILWAY MAGAZINE, of a photograph by Mr. F. E. Mackay showing a West Coast express drawn by two "Precedent" locomotives—a combination so famous in the past—brings to mind a recent experience involving one of the two engines illustrated. Travelling from Carlisle to London recently on a Saturday night, when the arrangements are somewhat different from those during the rest of the week, the Stranraer section consisting of two bogie coaches and a sleeping car was sent on to Crewe separately, instead of waiting for the Aberdeen train, behind 2-4-0 locomotive No. 1678 *Airey*. There was nothing specially remarkable about the running, except that with this light load the old "Precedent" was well suited, and was not daunted by the hardest grades of the southbound journey, being able to keep up a steady pace without difficulty.

Leaving at 1.16.50 a.m., Penrith was passed in 24 min. 10 sec. (17¾ miles), the 19 miles to Tebay in 26 min. (the summit time at Shap was lost in the darkness); thence to Oxenholme, 13 miles, occupied 13 min. 45 sec.; Carnforth, another 13 miles, was passed in 13 min. 15 sec.; and the 27¼ miles thence to Preston were run in 31 min. 15 sec. Traversing the station at reduced speed the 15 miles to Wigan occupied 19 min. 50 sec., after which signal checks near Acton Bridge and thence to Crewe caused the 36 miles from Wigan to Crewe to take 47 min. 35 sec. The complete run of 141 miles from Carlisle therefore occupied 178 min. 50 sec. At Crewe the Stranraer coaches were attached to the Greenore boat express, and continued with a load of 380 tons behind No. 1087, a "Claughton."

Retirement of Sir A. Kaye Butterworth.

THE retirement of Sir A. Kaye Butterworth from active railway life at the end of last year, already recorded, is an event which needs more than a passing mention. His railway career began in the Solicitor's Office of the Great Western Railway, and while there he took an active part in the railway rate inquiries, which led to the passing of the various Rates and Charges Order Confirmation Acts of 1891 and 1892. On the North Eastern Railway his first office was that of Solicitor, to which he was appointed in 1891, becoming General Manager in 1906. With his legal training he brought to bear on the many problems of management that judicial temper and charm of manner which have made him so acceptable as an arbitrator, and it is one of the many tributes to his personality that the terms of the Conciliation Conference, which he framed several years ago for the settlement of wages and conditions of service on the North Eastern Railway, have remained substantially unaltered. As a member of the Board of Trade Railway Conference of 1908 he contributed a valuable memorandum on competition which will be found in the report of that body, and his unique position in the railway world is shown by the fact that during the war he was chosen to be Chairman of the Compensation Accounts Committee, and also Chairman of the Commission appointed to arrange the terms of payment for the use by the British Army of the railways in France and Belgium. Again, in 1920, Sir Alexander was chosen to give evidence on behalf of British railways before the Rates Advisory Committee.

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MR. G. H. WHEELER, who has been appointed Traffic Superintendent of the Somerset and Dorset Joint Railway in succession to Mr. W. J. England, began his duties in Bath on January 2. Mr. Wheeler entered the office of the then superintendent of the line on the London and South Western Railway (Mr. A. J. White) in 1897. Practically all his railway experience has been gained in connection with the Traffic Department of that company. In 1914 Mr. Wheeler was transferred to the military department of the company, which superintended the operations of naval and military transport. In June, 1917, he became assistant to the secretary of the Railway Executive Committee under the Board of Trade, and two years later in June, 1919, was appointed secretary. He was subsequently made secretary to the Standing Committee of General Managers, with offices at Parliament Street, Westminster. He retained this appointment until the general de-control of railways on August 16 of last year. Mr. Wheeler is still quite a young executive officer, for he is just over 40.

Elliott] [*& Fry.*

MR. G. H. WHEELER,

Traffic Manager,
Somerset & Dorset Railway.

* * *

MR. W. H. PEARSON, M.B.E., Central District Passenger Superintendent of the Lancashire & Yorkshire Railway, retired on December 31, after 50 years' service. Mr. Pearson joined the Department of the Superintendent of the Line on January 1, 1872, and after passing through the various sections became Chief Clerk in 1905, remaining in that position until January, 1919, when he was appointed Central District Passenger Superintendent.

* * *

To Strawberry Hill locomotive depôt belongs the distinction of having given the largest percentage of lives during the Great War, as regards the London and South Western Railway. The Memorial at that depôt is, therefore, of special interest in that so large a proportion of those who joined His Majesty's Forces therefrom made the supreme sacrifice. It is placed in the engine and firemen's classroom. The basic design is in marble relief, with the usual emblems — the Army and Navy ensigns. On side panels are the names of those who have served in the war and returned to duty. In the centre is depicted the Cenotaph, giving the names of those who gave their lives. At the base are emblems of the electrical and locomotive departments — an engine on one side and an electrical unit on the other. At the foot of the design representatives of both services are keeping guard. Altogether Strawberry Hill depôt contributed 142 men to the forces, of whom 19 gave their lives. The cost of the memorial was met by subscriptions from some 440 of the men at Strawberry Hill, and from Chertsey, Ascot and Reading, together with the electrical staff associated with the depôt.

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The memorial was executed by Mr. E. W. Barnes, of the Locomotive Accountant's Department, Eastleigh.

* * *

MR. R. D. ROBINSON, the Goods Agent of the Great Central at Sheffield, has retired after 46 years' service, having commenced at Barnsley, at which place he was appointed Chief Clerk, in 1883, and Goods Agent in 1899. He was afterwards transferred to Rotherham, where he was Goods Agent for 13 years, and removed to Sheffield in 1919. There were periods during Mr. Robinson's service which necessitated a great amount of tact and heavy work, but he always surmounted them in a most able manner. Mr. J. Rostern, C.B.E., the Chief Goods Manager, saw Mr. Robinson before he left, and personally expressed to him his appreciation of the way in which he had so zealously carried out his duties, and wished him health and happiness. The best wishes of Mr. Robinson's many friends go with him in his well-earned retirement.

* * *

A CONSIDERABLE number of railway officials in the Sunderland area were present recently at Heworth Churchyard to take part in the ceremony of unveiling a monument, in white marble, which has been raised by railwaymen in memory of a colleague, the late Mr. Thomas Ison, who was in the service of the North Eastern Railway for 50 years.

* * *

AT the Cannon Street Hotel, January 6, was held the 12th Annual Re-union and Dinner of the Superintendent of the Line and staff (past and present), South Eastern and Chatham Railway. The Superintendent of the Line, Mr. Edwin C. Cox, C.B.E., presided, and the company present included Mr. H. A. Sire, C.B.E., Goods Manager, London, Brighton and South Coast Railway (a former Assistant Superintendent of the Line), Mr. J. C. Taylor, of Messrs. McCorquodale & Co. Ltd., Mr. H. E. O. Wheeler, O.B.E. (Assistant Superintendent of the Line), Mr. H. H. Hayter (Chief Outdoor Assistant), Mr. E. J. Missenden (London District Superintendent), and Messrs. J. W. Taylor, E. W. Honeysett, H. W. Dunk, M.B.E., and P. C. Hopper, M.B.E. (Station Superintendent, Victoria), also a number of ladies (past and present members of the staff). The gathering was one of the most successful of its series, and the efforts of the dinner committee were duly acknowledged in a happy speech by Mr. H. E. O. Wheeler.

AT an Institute of Transport meeting held on January 9, at the Institution of Civil Engineers, Westminster, S.W. 1, Sir R. Francis Dunnell, Bart., K.C.B., read a paper on "Transport Law."

* * *

FOR the year 1922 the presidency of the Railway Benevolent Institution has been accepted by the Hon. Charles N. Lawrence, Chairman, London & North Western Railway, and he will take the chair at the anniversary dinner which will be held on Wednesday, May 3, at the Hamilton Hall, Great Eastern Hotel, Liverpool Street Station, London, E.C. Mr. Frank Tatlow, General Manager, Midland Railway, has become Chairman of the Board of Management of the Institution for the current year.

* * *

AT a recent meeting of the Great Western Railway (London) Lecture and Debating Society, Mr. A. Paton, Goods Agent, Caledonian Railway, Dundee, read a paper entitled "Will British Railway Grouping bring about American Operating Conditions?" Mr. H. R. Griffiths, O.B.E., Divisional Superintendent, Bristol, Great Western Railway, presided over a large attendance. Considerable discussion followed the reading of the paper, and among those who addressed the meeting were Mr. R. H. Nicholls, C.B.E., Superintendent of the Line, Great Western Railway, Mr. G. Bulkeley, Mr. A. W. Arthurton and Mr. Charles Travis. The prevailing opinion was that while some development towards American conditions was possible—and desirable—British railways individually had in years past done their utmost to move along the lines indicated. In general, however, innovations had been no more than a partial success, but where it could be shown to be advantageous, British railways were ready now, as in the past, to introduce new methods.

* * *

THE Minister of Transport has recently confirmed the Order made by the Light Railway Commissioners—Totton, Hythe and Fawley Light Railway Order, 1921, authorising the construction of a light railway from Totton to Fawley in the county of Southampton.

* * *

IN sending a cutting from a New York paper illustrating a 2-8-8-2 locomotive built by the American Locomotive Company for the Peking-Suiyuan Railway, China, weighing 320 tons with tender and said to be the largest locomotive ever shipped from the United States, Mr. L. J. Hyslop mentions

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a new feature of working on the New York Subway. A flexible loud-speaking telephone is provided at the side of the centre doorways of subway cars into which the conductors speak while standing at a station, giving the name of the next station and other usual announcements and injunctions, which could thus be heard clearly, although he himself spoke quietly without shouting, as would otherwise be necessary.

* * *

THREE new four-cylinder 4-6-0 locomotives of Mr. E. A. Watson's "400" class are now in service on the Great Southern and Western Railway, Nos. 401, 402 and 406. Nos. 403–4–5 are being built in England. The new engines are used on the up and down mail trains, and No. 401 was used during the summer for heavy excursiou trains between Dublin and Cork.

* * *

MR. W. A. TAPLIN, of Huddersfield, writes that the new London and North Western Railway locomotives of the "Prince of Wales" class, built by Beardmore's, have Joy valve gear arranged similarly to that employed on the 4–6–2 superheater tanks. It differs from that in the previous "Princes" in that the radius rod is connected direct to the valve spindle, instead of through the medium of a rocking lever and is attached to the vibrating link at a point below, instead of above the sliding dies. This arrangement eliminates three pin-joints, thus reducing the amount of lost motion. The ends of the valve spindles move in slides similar to those fitted to many of the "Precursor," "Experiment," and 19-in. goods classes. One of the early "Princes," No. 479, *Thomas B. Macaulay*, has been running for about 12 months with valve gear of this form, presumably as an experiment. No. 244 of the new batch is at present stationed at Shed 26 (Edge Hill). It is painted dull black, without lining, and the usual coat of arms on the driving wheel splashers is omitted.

* * *

FROM Crewe Mr. C. Williams writes:—W. Beardmore and Co., Limited have now delivered to the London and North Western Railway 50 of the order for new 4-6-0 passenger engines ("Prince of Wales" class), thus leaving 40 others yet to come. The following are the most recent arrivals: Nos. 246-9, 251, 252, 258, 259, 261, 266, 394, 267-70, 272-4, 277, 281, 292, 293, 296, 313, 324, 325, 331, 355, 357 and 359. All have been built at the firm's Dalmuir Works, the makers' Nos. of which are 194–223 inclusive, in the order given. No. 394 replaces a 6 ft. 6 in. 2-4-0 passenger engine named "Eamont," which has been scrapped, while the remainder were formerly 0-6-2 tank engines, but are now transferred to the duplicate list as Nos. 3746-64, 3053, 3105, 3109, 3119, 3151, 3209, 3231, 3271, 3320 and 3325 respectively.

* * *

AT Crewe, a further series of 0-8-0 superheater goods engines ("G2" class) will shortly make its appearance, Nos. 367, 369, 373, 407, 411, 417, 429, 382, 396 and 1530. The first seven replace 0-6-2 tank engines, which have been re-numbered 3029, 3058, 3339, 3353, 3356, 3387 and 3414 respectively; and the remaining three 6 ft. 6 in. 2-4-0 passenger engines, but these latter are now scrapped. No. 811 "Express" ("Precursor" class) has been fitted with superheater. The special DX goods engines, Nos. 3005, 3285 and 3287 (formerly Nos. 1618, 283 and 1613 respectively) have been broken up.

* * *

A BATH correspondent writes that a further addition is being made to the already large number of 2-6-0 mixed traffic engines on the Great Western Railway. On January 5, he noticed No. 7300 of this class—the highest number he had so far seen carried by a Great Western engine. The selection of this number suggested to our correspondent that this engine, according to the present system of numbering on the Great Western Railway, must be the first of a new class, and that approximately 300 of this type, numbered respectively as the 4300, 5300, and 6300 series, must be already in service. No. 7300 bore the makers' plate of Messrs. Robert Stephenson & Co., and was fitted with the tapered chimney which now finds favour on the Great Western Railway.

* * *

ANOTHER stage towards completion of the reconstruction of Waterloo Station has been reached by the opening of the handsome new buffet, opposite No. 15 platform. Decorated in marble and plaster, with mahogany counter front and back fitting. It is 79 ft. long, 39 ft. wide and 18 ft. high. The walls are panelled in marble to the height of 9 ft. with Greek Cipollino, and statuary in bays of 11 ft., colour being introduced with rouge marble set in upper panels. The centre piers are in fluted Sienna with columns in Greek Cipollino, these having bronze caps and bases. The four supporting fluted columns are also in Sienna with statuary caps and bases, the flooring being in square of Greek Cipollino and statuary. The upper portion of the buffet is in plaster with Grindling Gibbons orna-

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ment very successfully treated with drooping swags over marble work.

* * *

On the Great Northern Railway seats may be reserved in through trains and carriages upon payment of a booking fee of 1s. per seat. The arrangement, which dates from January 2, applies to trains or through carriages commencing the journey at London (King's Cross), and other principal stations, including Boston, Bradford, Cambridge, Derby, Doncaster, Grantham, Grimsby, Hatfield, Hitchin, Leeds, Leicester, Lincoln, Mablethorpe, Nottingham, Peterborough, Skegness and Sutton-on-Sea, but it will not be possible to reserve seats for passengers joining through trains or carriages at intermediate stations. Full particulars can be obtained from the stationmasters at the respective stations, to whom applications for reserved seats should be made.

* * *

On and from Sunday, January 8, the London Underground station at Covent Garden has been re-opened for traffic from 6 p.m. onwards. This is to meet the convenience of Sunday evening audiences at Covent Garden Theatre. The continued opening will depend upon the traffic results of the experiment.

* * *

Beginning on Sunday, January 1, many improvements and accelerations were made in train services on the Metropolitan and Great Central Joint Line, particularly in regard to Northwood, Rickmansworth, Chorley Wood, Amersham and Aylesbury, which are brought respectively within 27, 30, 36, 43 and little more than 60 minutes of town. All the favourite and growing residential districts served by the line, indeed, share in the general policy of acceleration rendered possible largely by the proved capabilities of the 4-4-4 superheater tank engines recently introduced, built by Messrs. Kerr, Stuart & Co., Limited, and described in the Railway Magazine. Acceleration is principally made by starting up trains several minutes later than before, the times when reaching the London district being as hitherto, one or two minutes being picked up on each stage. In the down direction trains are expedited beyond Northwood, the departure times from the London termini remaining as hitherto. On Saturdays a Pullman car will be attached to the 1.37 p.m. from Liverpool Street to Chesham, but will be withdrawn from the 12.37 p.m. from Aldgate to Amersham and the later afternoon trains. Alterations and additions are also included in the electric services on the Harrow and Uxbridge routes.

The Great Western Railway Company announce that Worle station has been closed for traffic from January 1. Commenting upon this a correspondent remarks :—This station is the junction for the Weston-super-Mare loop, but no important trains to the seaside town call there, and presumably the company consider that the local traffic no longer justifies the maintenance of a station staff. The motor 'bus service which has been established by the Bristol Tramways Company between Weston and Worle, and places beyond, no doubt furnishes the real explanation of this decision. Indeed, if the railway company's point of view were ascertained, it would probably be found that they place Worle and some other stations in the same category as Twerton, near Bath. The closing of Worle station may be regarded as an indication that the re-opening of Twerton station has been relegated still more definitely to the limbo of unlikely possibilities.

* * *

At the meeting of the Bath City Council on January 3, a reply was read from the Pullman Car Company to the request from the corporation that these cars should be put into service on the Great Western Railway between Paddington and Bath. The Pullman Company stated they would be pleased to establish such a service if the Great Western Railway Company would consent.

* * *

It has been suggested that "Southampton West" station should be re-named "Southampton Central." It is stated that strangers misjudge the importance and convenience of the station through the word "West" being used. An illustration of this station is given on page 98.

* * *

London & North Western Railway Holyhead fleet of trans-channel boats has been supplemented by the new *Scotia* and *Cambria*. They are in all respects repeats of the *Anglia* and *Hibernia*.

* * *

The Railway Rates Tribunal makes the following announcement: "The Railway Rates Tribunal appointed under the Railways Act, 1921, has issued temporary directions to be followed in proceedings before the Tribunal. The document is issued by H.M. Stationery Office, price 2d., and contains a preliminary statement that until General Rules of Court are made in pursuance of Section 22 of the Railways Act, 1921, and approved by the Lord Chancellor, the Lord President of the Court of Session and the Minister of Transport, the directions set out therein are to be followed."

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In view of the increased public appreciation of art values nowadays, it is encouraging to see the larger scope given to artists in the commercial world. One of the most pleasing instances is the application of woodcut design to advertisement posters. The striking contrasts and expressiveness which characterize the woodcut style are well calculated to attract the eye, and consequently the style is eminently adapted to poster design. The London, Brighton and South Coast Railway has recently issued a striking woodcut poster designed by Mr. C. D. McGurk, which has for its subject a picturesque corner of the quaint Sussex town of Arundel. The Company is to be congratulated on having illustrated how perfectly the requirements of the commercial world can be served with this revived branch of art.

* * *

Prominent among the railway calendars for 1922 is that produced by the London, Brighton and South Coast Railway Publicity Department, where all that is high-class in art is recognised, and good taste invariably prevails. The calendar in question carries an excellent colour picture of Chichester Market Cross, which is considered the finest structure of its kind in existence, while the bottom of the print depicts the "Sunny South Coast," from Hastings in the east to the Isle of Wight in the west.

* * *

Always up to date with its posters, the London Underground Railways produced some striking designs for the adornment of its notice boards and hoardings, which were appropriate to the January sales and the pantomime season. Already London tube travellers are speculating as to what novelties the Press Bureau at St. James's Park will issue for Easter, the Oxford and Cambridge boat-race, and such-like coming events.

* * *

Special late trains, leaving central points about 20 min. after the last ordinary trains, which were put on as an experiment from Piccadilly Circus and Leicester Square, serving the Piccadilly, Bakerloo, Golders Green and Highgate lines, have not received sufficient public support to warrant their continuance. Careful observation has shown that they are not wanted. The night life of London is not yet reviving to an extent which would justify the provision of these special facilities. The Underground, therefore, withdrew the special late trains from service after January 14. No alteration has been made in the departure times of the last ordinary trains. These leave the central points at 12.30 a.m. as hitherto.

* * *

As in many former years the recent annual dinner of the Railway Club was held at the Holborn Restaurant under the presidency of Mr. W. Parker. The function was most enjoyable, an excellent repast being followed by brief speeches and a capital musical programme. Mr. Basil M. Bazley, the Hon. Secretary, was highly complimented on the success of his arrangements for the comfort and enjoyment of the diners. Mr. Cecil J. Allen, the president-elect, took the chair at the January general meeting at 65, Belgrave Road, S.W.1, when Mr. H. L. Hopwood gave an excellent lecture on "The G.N.R. in the West Riding."

* * *

Mr. J. W. Harris, the Chief Clerk to the Superintendent of the Line at Euston is retiring after 46 years' service with the London and North Western Railway. He started as a junior booking clerk at Euston in 1876, and in 1881 was transferred to the District Superintendent's office. In 1888 Mr. Harris moved to the office of the Superintendent of the Line, where (in 1906) he was placed in charge of the Excursion and Advertising Section. Since November, 1914, he has occupied the post of Chief Clerk. For 26 years Mr. Harris has been very intimately connected with the work of the London and North Western Library and Literary Association, either as Secretary or Chairman.

* * *

Mr. John Marchbank, the President of the National Union of Railwaymen for 1922, worked as a shepherd boy till he was 14, and then as cattleman and dairyman. Subsequently he became a porter on the Caledonian Railway.

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THE RAILWAY MAGAZINE.

Photo : W. J. Barker.

NORTH EASTERN RAILWAY.

Up Scotch Express near Northallerton.

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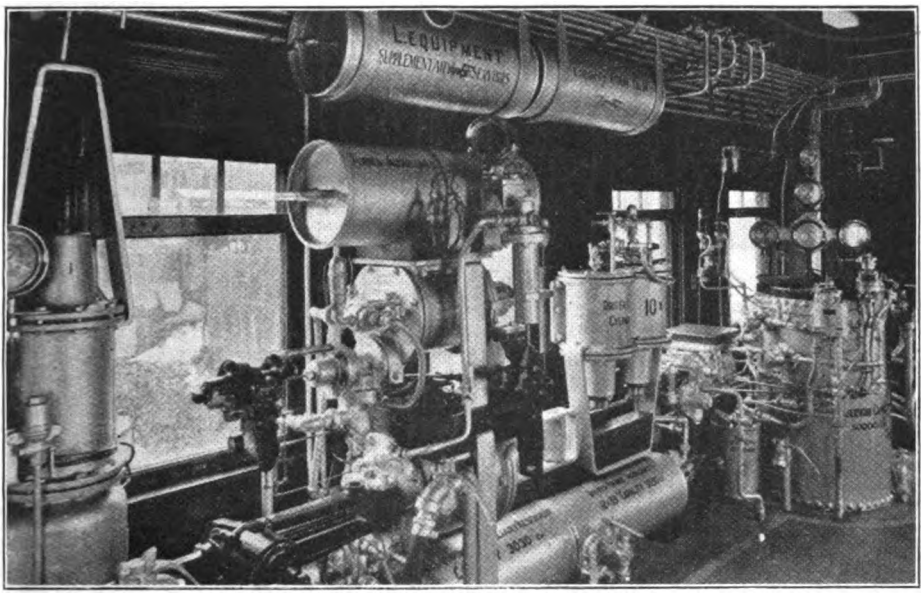

INTERIOR VIEW OF CANADIAN PACIFIC RAILWAY INSTRUCTION CAR FOR ENGINEMEN.
Showing Westinghouse Brake Demonstration and Instruction Equipment.

Angus Workshops, Montreal, Canadian Pacific Railway.

WE are indebted to Mr. E. C. Gill, Publicity Agent in London of the Canadian Pacific Railway, for the following particulars of the Angus Workshops in Montreal; also for the illustrations reproduced. These works, the mechanical headquarters of the Canadian Pacific Railway in Montreal, rank among the biggest and best of their kind on the American continent, and constitute a prominent feature of the industrial life of Canada. The locomotive and car shops are situated at the eastern end of Montreal, on an elevated plateau overlooking the St. Lawrence River. They cover an area of 320 acres, and have a trackage of some 32 miles. Between 7,000 and 8,000 men are employed, the annual pay-roll amounting to about $13,000,000. The facilities allow for the repair of about 720 engines a year and the building of about 50 new locomotives; passenger car repairs are about 3,000 per year and the building capacity is approximately 180. The number of freight car repairs is around 24,000 a year and 6,000 freight cars can be built.

The shops have been largely extended and re-modelled in recent years, so that the equipment is essentially up-to-date. Acetylene gas jets are largely used for cutting metal, and electric welding is widely employed. All through the shops appliances are worked by compressed air wherever feasible. A noticeable feature is the conversion of scrap. The wheel of a hand-brake, for instance, is made up as the wheel of a wheelbarrow. Old pipe is made into the framework of farm gates, showing the close and careful management which looks into every detail.

The most powerful type of engine is required for hauling over the great distances covered by the Canadian Pacific Railway, and the locomotive boiler shops are probably unequalled on the American continent. The general storehouse, on the Midway, on the opposite side from

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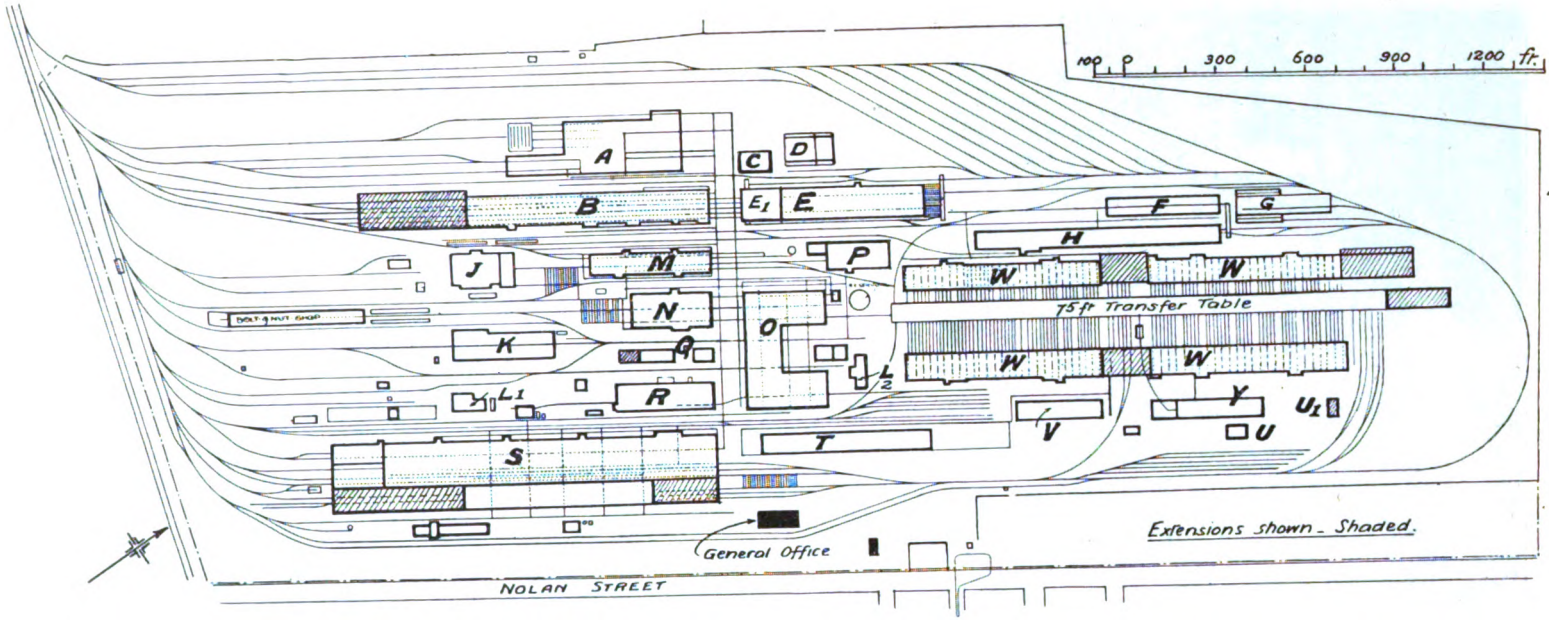

GENERAL PLAN OF ANGUS WORKSHOPS, CANADIAN PACIFIC RAILWAY, MONTREAL.

A. Steel car shops.
B. Freight car shop.
C. Maintenance building.
D. Kiln.
E. Planing mill.
*E*1. Planing mill shelter.
F. Hard wood store.
G. Car electrical shop.
H. Cabinet shop.
J. Wheel foundry.
K. Frog and switch shop.
L. Lunch rooms.
M. Truck shop.
N. Car machine shop.
O. Blacksmiths.
P. Power house.
Q. Pattern shops and storage sheds.
R. Grey iron oundry.
S. Locomotive shops.
T. General stores.
U. Carpet shop.
*U*1. Carpet shop, new position.
V. Brass and varnish shop.
W. Passenger car shops.
Y. Upholstery.

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the locomotive works, is a building where before the war disbursements of materials amounting to well over $1,000,000 a month were made; under present conditions this sum has, of course, been very substantially enhanced. In the casting shop about 40 tons of material is the daily capacity. All the switches, frogs and accessories for the line are made at the Angus shops. The capacity is over 300 complete sets per month. A feature of this department is a large rail saw and six powerful rail planers. The saw can cut through an 80-pound rail in one minute.

Every day in the year over 300 car wheels are turned out. The machine shop of the car department takes care of all the metal work entering into the construction of both freight and passenger cars. Here are to be seen powerful drilling machines that can put six holes in a truck arch bar at one time. Bolt-screwing and nut-tapping machines, lathes for turning up the tires on car wheels, planing, milling and shaping machines are parts of the equipment in this shop.

Bogies for both passenger and freight cars are built in the "truck" shops. Axles are all turned to standard gauge, and the wheels bored to fit them. They are then pressed on by hydraulic pressure, which is recorded by an automatic gauge, and the record charts kept in the office for future reference. So systematically does the machinery work here that two men can turn out 150 pairs of truck wheels a day. Many who have visited the Angus shops consider the freight car erecting shops among the most interesting features of the vast plant. Here cars are seen practically made to order while one is waiting.

To the east of the power house are the passenger car erecting and finishing shops. There are two of these shops on each side of a long pit in which are electrically-driven traversing tables. The cars manufactured here include baggage, mail and express cars, Colonist cars, first-class day coaches, parlour, dining and sleeping cars. In addition to the huge number of cars which go through these shops for repair purposes, a car for every working day of the year is turned out. The Canadian Pacific Railway takes particular pride in the upholstering department, and this, with the cabinet department, is housed in a large and splendidly-equipped building.

In order to speed up on the construction of equipment required for the rapidly-extending traffic on the Canadian Pacific Railway, large extensions were inaugurated recently. These extensions will cover 250,000,000 sq. ft., at an approximate cost of $1,000,000. The largest additions will be made to the passenger car shops, amounting to 71,000 sq. ft., while over 58,000 sq. ft. will be added to the locomotive shops, and 42,400 sq. ft. to the freight car shops. A new electrical car shop, with a floor area of 23,000 sq. ft., is being erected. The construction will be steel frame, concrete foundation, with brick walls and acid-proof mastic floor. A new heavy service tapered floor track scale is being installed, of a capacity large enough to weigh locomotives. The construction will be of the most modern type, with self-registering beam, scale shelter and concrete pit. The floor of the scale will be steel beams and stands, with a mastic scale platform. A number of track changes and additions will be made at both ends of the yard to provide extra car capacity. There will also be installed a 50-ton mechanical coaling plant, as well as a new standpipe for the use of switching engines.

The policing of this great aggregation of buildings is done by a system that has been found generally satisfactory. The company has a uniformed force patrolling the grounds day and night. The fire protection service is no less ample. There are drills every week and alarms are given at intervals to test the vigilance of the men.

Among the thousands of men now at work in the Angus shops are many who had their first lesson in locomotive and car making in the Angus school. At this school the instruction system covers every actual and related thing that can be considered of value to a railroad builder or operator. There is a primary education for apprentices, consisting of reading and writing, elementary arithmetic, and geography of the Canadian Pacific system, biographical sketches of past and present eminent Canadians, freehand drawing, and training in punctuality, regularity, thoroughness, application and thrift, self-reliance, cleanliness, &c.

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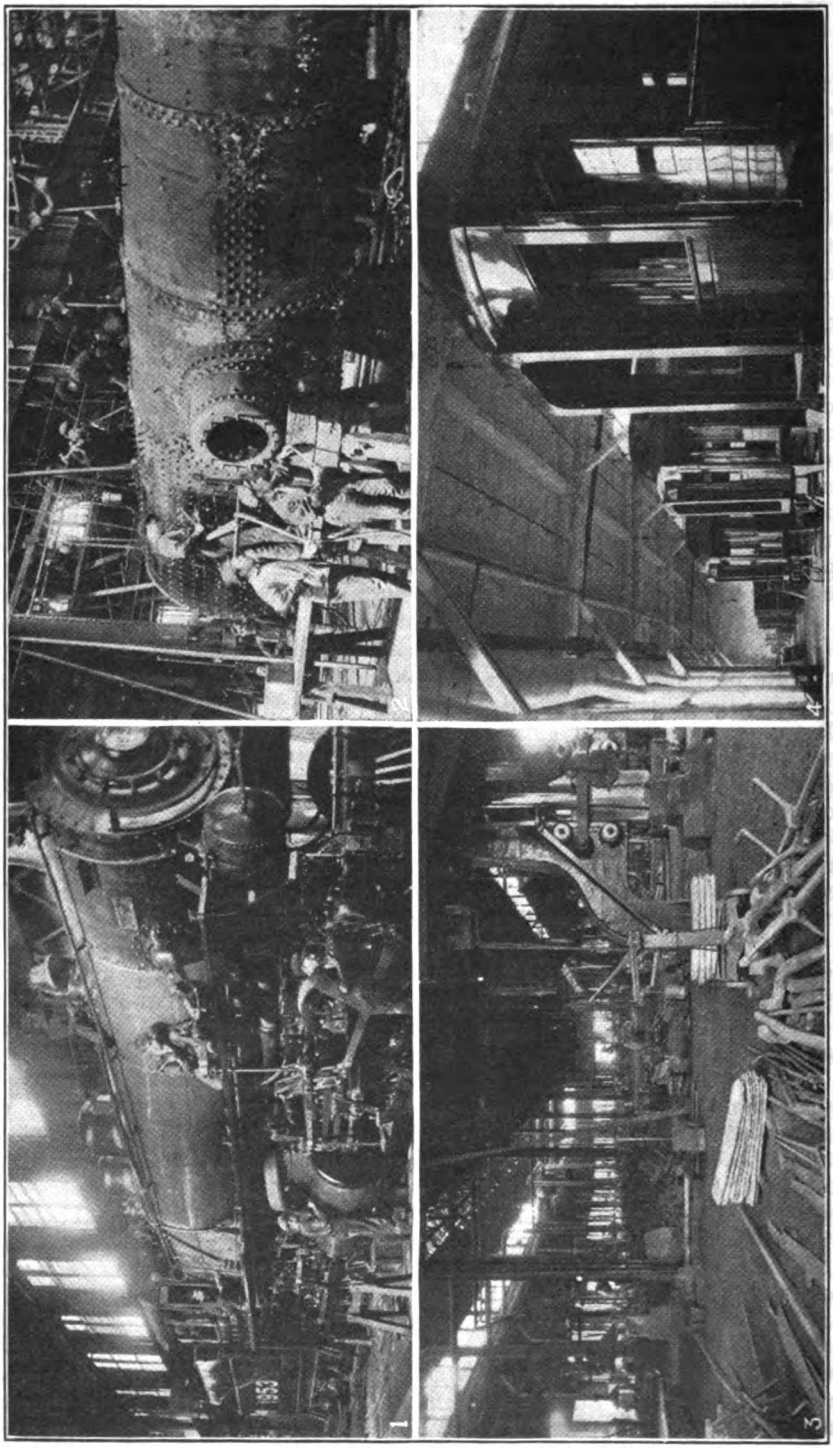

VIEWS IN ANGUS WORKSHOPS, CANADIAN PACIFIC RAILWAY.

1. Erecting Shop.
2. Boiler Shop.
3. Smithy.
4. Car shop.

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The young employee, after he has successfully mastered the primary requirements, is initiated in shop mechanics, including every phase essential for his future occupation. The practical work of the boys in the shops takes place under the supervision of specially qualified instructors. In order to encourage the deserving apprentice the company donates each year ten scholarships in courses taught by special instructors. There are also two scholarships each year, tenable for four years at McGill University, Montreal, to sons of employees. The holders of these McGill scholarships are employed by the company during vacation and receive remuneration for their services.

The Angus shops are named in honour of that great Scottish Canadian, Mr. R. B. Angus, to whom belongs the unique distinction of having acted as a director of the company since its inception to the present time. Born at Bathgate, Scotland, in 1831, since the death of Lord Mount Stephen, he is the only surviving member of the original board of the Canadian Pacific Railway, incorporated in 1881.

NEW 4-6-2 LOCOMOTIVE, NEW ZEALAND GOVERNMENT RAILWAYS.

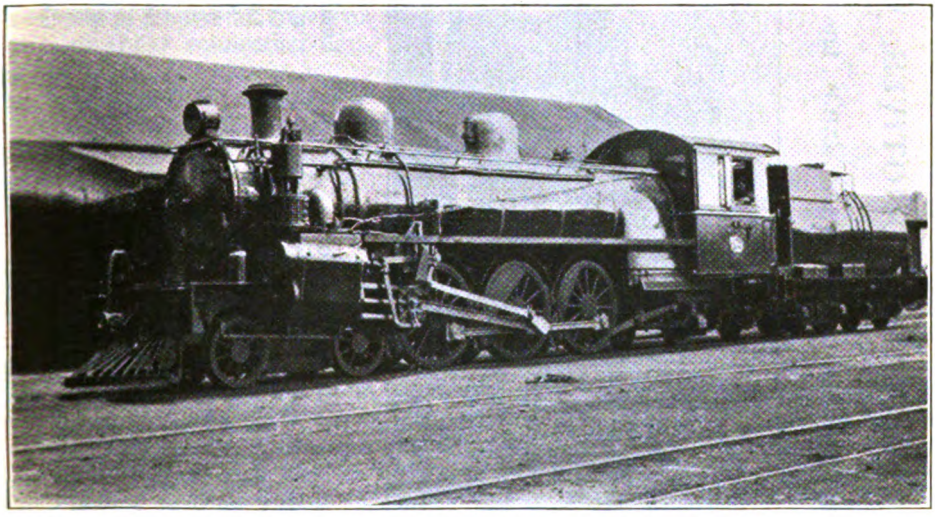
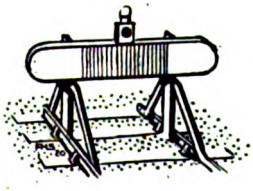


Photo.] [*C. J. Housego.*

LOCOMOTIVE NO. 748.

Photographed in December, 1921, shortly after the arrival of the first of the series. Built by the North British Locomotive Company, Limited.



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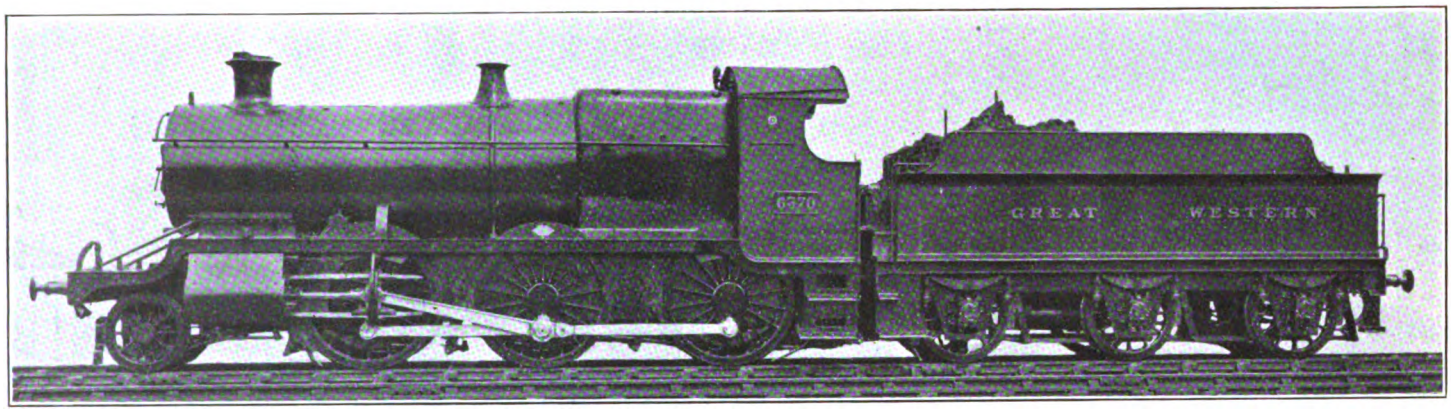
NEW 2-6-0 MIXED-TRAFFIC LOCOMOTIVES, GREAT WESTERN RAILWAY.

Designed by Mr. G. J. CHURCHWARD, C.B.E., late Chief Mechanical Engineer.



THIS useful class, numbered 4300-4399, 5300-5399, 6300-6399 and 7300-7304 was illustrated and described when first introduced, but a view of a more recent example is of interest. The last 35, Nos. 6370-6399 and 7300-7304 inclusive, have been constructed by Messrs. Robert Stephenson & Co., Ltd., all others being Swindon-built. The engines include Swindon superheater and top-feed water supply.

Leading dimensions are:—

Cylinders	18½ in. by 30 in.
Coupled wheels	5 ft. 8 in. diam.
Leading wheels	3 ft. 2 in. diam.
Steam pressure	200 lb. per sq. in.
Weight in working order—	
Engine	62 tons.
Engine and tender ...	102 tons.
Heating surface—	
Tubes	1349·64 sq. ft.
Firebox	128·72 ,,
Superheater	212·58 ,,
Total	1690·94 ,,
Grate area	20·56 ,,

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Making Up Lost Time.

By LORD MONKSWELL.

PERFECT punctuality, which renders unnecessary the making up of lost time, is no doubt the ideal at which railways should aim. But in this imperfect world that ideal, though it may be more or less nearly approached, can never be completely attained. Even on the best managed railways there will always be a certain number of cases in which time is lost, and when this happens what ought to be done?

The particular drawback attaching to unpunctuality on a railway is that the loss of time by one train inevitably involves the delay of others. If one train is behind time all trains connecting with it, those timed to follow it closely and, very likely too, some which have to cross its path are affected. Indeed, it may safely be said that as a rule the unpunctuality of one important train affects detrimentally the whole of the traffic of all the districts through which it passes.

Unpunctuality is wasteful in two ways. First and foremost it wastes time, which is life. The life of each one of us consists of so much time. This time once wasted is gone for ever. It can never be replaced. Time unnecessarily lost through railway unpunctuality is a dead loss of national efficiency, in that it deprives those railway passengers whose time is of any value of a certain part of this valuable time. The sum of the amount of human efficiency lost through the unpunctuality of some important train containing several hundred passengers and involving the further unpunctuality of many other trains, all with their own complements of passengers, may be very great and represent the loss of a large sum of money.

Secondly, there is the direct financial loss due to disorganisation caused by unpunctuality. Every extra stop costs something in increased wear and tear, and all the work in connection with the delayed trains has to be done at some time other than that foreseen and can hardly help causing unnecessary expense both to the railway itself and to its customers.

Causes of Late Running.

Unpunctuality is therefore, an expensive thing in itself, and from mere motives of economy should be reduced to the lowest point. When time has once been lost the only way of setting things right again, or at any rate of minimising the trouble, is to make up the time lost as quickly as possible.

What are the objections to doing this? I can think of three:—

(1) *Restricted Engine Power.*—The engine may not be sufficiently powerful to put forth the extra effort required. If this is so there is obviously nothing to be done and the case calls for no further consideration.

(2) *Danger.*—A great deal of vague nonsense is talked about the danger from excessive speed due to the making up of lost time. Actually, of course, the possible dangers arising from excessive speed are accurately known and perfectly easily guarded against. For the most part they arise on secondary lines where the permanent way is not sufficiently solid to bear the strain of a train running beyond a certain speed. There are also certain types of vehicle, particularly engines, that cannot with safety be allowed to exceed certain prescribed speeds. With first-class rolling-stock running over the solidly constructed and carefully maintained permanent way of main lines of railway there is clearly no danger from excessive speed, except at particular places, such as sharp curves, where it is always necessary to reduce speed whether a train is making up time or not. Very high speeds have so often been authentically recorded on suitable parts of almost all the principal main lines of the world that there can no longer be any serious question of danger about them. And if it is thought inadvisable to give the drivers permission to go "all out" down hill, nothing is easier than to prescribe the limits that

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must not be exceeded, as is habitually done on the Continent of Europe. It really makes very little difference to time-keeping what are the maximum speeds downhill. Where time is to be gained is by increased speed uphill and on the level. By running at 90 m.p.h. instead of 80 m.p.h. downhill 5 sec. are gained each mile, but by running uphill at 60 m.p.h. instead of 50 m.p.h. 12 sec. are gained each mile.

At the sharp curves and other places where speed must be limited it is no doubt important to take precautions by means of automatic recorders to ensure that the safe limit of speed should not be exceeded. But this is equally the case whether time is being made up or not, and to suggest that a driver who has received suitable instructions and who knows that any failure to comply with his instructions will be detected, cannot be trusted to carry them out when making up time, appears to me fantastic.

(3) *Expense.*—To make up time the engine will no doubt have to work harder and will consume more coal, and the strain on the boiler and possibly on the machinery will be increased. It is, of course, difficult to give exact estimates as to what the extra expense is likely to amount to. It would be very interesting if anyone who has access to any information that may exist on the subject would deal adequately with that point. My own belief is that it would amount to a very small fraction of the sum lost by refraining from making up lost time. Even, for instance, with coal at the present abnormal price, circumstances could hardly be found in which the making up of all the lost time possible would work out at more than 6*d.* a mile.

PRACTICE IN OTHER COUNTRIES.

On general principles, therefore, it appears that the making up of lost time has everything to recommend it. I suggest that the matter ought to be carefully thought out by the railway companies and precise, printed instructions issued to the engine drivers setting out exactly what is expected of them. This has for long been done in France, where many years ago it was specifically recognised by the Ministry of Public Works that the making up of lost time was conducive to safety.

In the year 1895, some question having arisen whether premiums paid to the engine drivers for the making up of lost time should be discontinued, the French Ministry of Public Works addressed a circular to the various companies containing a passage of which the following is a literal translation :—

> "But if it is important to avoid excessive speed it is not less indispensable to prevent delays as far as possible or to attenuate those which occur on the way. Independently of the disturbance which these irregularities import into the service and of the complaints on the part of the public to which they give rise, they often become the cause of serious accidents."

So far as I know it is, and always has been, the practice in France to pay the drivers so much for every minute of lost time which they regain.

The following is a translation of the printed instructions issued to engine drivers by the Paris-Orleans Railway regarding the making up of lost time :—

> "When a delay has taken place enginemen must make every effort to regain on the remainder of the run the time lost on the first part of it; they must, however, always have their train under control and be able to stop, if necessary within a distance of 800 metres (½ mile).
>
> "The additional speed must never exceed half the regulation speed of the train on gradients which rise or fall less steeply than 1 in 100, and a third of the regulation speed on gradients of 1 in 100 or steeper."

All this is subject to the rule that the maximum speed on French railways must never exceed 120 km. (74½ miles) an hour.

As to the regulation speed of a train it should be explained that in the working time-tables of French lines each train is given a "regulation speed." This regulation speed is about equal to the average full speed of the train, say 3 m.p.h. faster than the average start to stop speed of its fastest run.

As regards Germany very similar instructions are issued to the engine drivers, at any rate, on the Prussian State Railways, which comprised at least two-thirds of the German railways before the war. (Since

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the war all the German lines have, I believe, been amalgamated into one Imperial system.)

These instructions are, moreover, really acted upon both in France and Germany.

Experience in France.

The first time I ever travelled on a French locomotive, more than twenty years ago, we made up 20 min. in a run of slightly over 80 miles. It was the afternoon boat train from Calais to Paris. This train at that time was given 103 min. for the run of 81¼ miles from Amiens to Paris. Leaving Amiens about 20 min. late we were stopped outside the Gare du Nord in just over 82 min. from Amiens. On this occasion we ran for something over 20 miles up gradients averaging about 1 in 350 at 60 m.p.h.—an experience entirely new to me in the year 1898, and one which I imagine would then have been new to most other people. Downhill only 16 km. (10 miles) all told, were run at 70 m.p.h. or over.

The late Mr. Charles Rous-Marten has recorded an instance of a Paris-Lyons-Mediterranée train, which, leaving Dijon 55 min. late, had regained 35 min. by the time it reached Laroche (99 miles).

While this important question is thus carefully considered and arranged for on the principal railways of the Continent, the matter seems to have been, and to be, almost entirely neglected in Great Britain. I write subject to correction, as in spite of many endeavours on my part I have never yet been able to ascertain how the matter really stands on most of the principal British lines.

British Drivers not Encouraged.

But so far as my investigations go I have been unable to discover that British drivers receive any printed instructions beyond the rule in the rule-book which directs them to work their train as nearly as possible in accordance with the booked times and in such a manner as to avoid excessive speed or loss of time. It is hardly possible to imagine anything more unsatisfactory than this rule. The language, which ought to be of the most precise possible kind, so as to leave no loophole for misunderstanding is, when examined, found to be vague to such a point as to have practically no meaning whatever. In particular there is no definition of "excessive speed," and as regards the expression "loss of time," there is nothing to show whether "loss of time" includes casual delays which should, therefore, be made up, or whether when casual delays have taken place the driver is not expected to trouble about them but just to go on keeping up the original booked speed. I suppose that some general understanding exists on these points and that the drivers probably receive verbal instructions about the making up of lost time.. What a man in the position of an engine driver should have are definite printed instructions setting forth in detail exactly what he is expected to do in each case, and he should be able to appeal to the actual text of his instructions if he wishes to do so. In a matter of high policy such as the making up of lost time all responsibility in principle should clearly rest with the officers of the line, and a subordinate like a driver should only have the responsibility for carrying out the clearly expressed orders of his superior officers.

Whatever may be the real state of the case as regards the instructions given to the locomotive men, I have no hesitation in saying that the way in which the making up of lost time is taken in hand in Great Britain has, in my experience, been extremely bad. Some railways are better than others, and an energetic driver will sometimes, apparently on his own initiative, make up time where a less energetic driver on the same railway will not. But in the whole of my experience on British railways the making up of lost time has been the exception, and I should say that when a train has been late in at least four cases out of five no attempt whatever has been made to regain time. In the case of some important railways, indeed, I have been informed definitely on the highest authority that the making up of lost time is not encouraged.

Each Train in its Place.

All this is very odd and illogical. The smooth working of a railway depends so obviously on each train being in the proper place at the proper time that I do not think that the paramount importance of working with the least possible departure from the pre-arranged plan can be challenged seriously. And it is particularly from the point of view of the utmost

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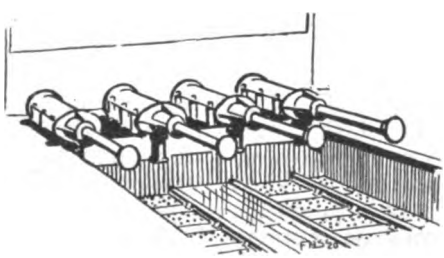
attainable measure of safety that I wish to direct attention to this matter. Clearly the possibility of mistakes taking place is much reduced if each train is, as far as possible, in the place assigned to it in the time-table. The supreme object lesson as to the danger of failing to make up lost time is furnished by the Gretna accident in 1915 on the Caledonian Railway, in which it is estimated that 227 persons were killed and 246 persons were injured. In this case it will be remembered that owing to the lateness of the express a slow train, timed to leave Carlisle after the express, was allowed to leave Carlisle in front of the express. At Quintinshill, near Gretna, this slow train was shunted on to the up line to allow the express to pass, and while standing on the up line was run into by a troop train. This accident could not have taken place if the London and North Western Railway had brought the Glasgow express punctually into Carlisle on the morning on which it occurred. In making this remark I impute blame to nobody. I am not aware whether this particular train on this particular night could have made up time or whether circumstances existed which rendered the making up of time an impossibility, and on this point no light is thrown by the Board of Trade report. I am aware also that in the matter of making up time the practice of the London and North Western Railway seems in general to be less unsatisfactory than that of most British lines. I merely point out that for some reason or other time was lost and had not been regained, so that the train was late at Carlisle, and that if the lost time had been regained so as to make the train punctual at Carlisle the accident could not have taken place.

A further remark which suggests itself is that it is extremely odd that the Board of Trade inspector did not consider it his duty to investigate in any way the reasons for the failure of the London and North Western Railway to bring the express punctually into Carlisle. It can only be supposed that the matter lay outside the scope of his instructions. As this unpunctuality was the predisposing cause of the accident to which all the other irregularities which took place were merely accessory, it may be suggested that the sooner the Board of Trade (or the Ministry of Transport, whichever department may happen at the moment to be responsible) widen the scope of their inspectors' instructions the better. It is indeed most strange that that department did not long ago realise the extreme importance, from the point of view of the safety of the travelling public, which attaches to the making up of lost time, so as to reduce unpunctuality to a minimum, and that it does not insist that every effort should always be made by the railways to make up as much lost time as possible, subject, of course, to any speed restrictions that, in their turn, may be essential to safety.

If the matter of the making up of lost time is not taken in hand seriously (and at the present time there are absolutely no signs whatever to indicate that this will be done) it may be predicted with the utmost assurance that in the future avoidable accidents will take place, which, looked at from the lowest point of view, will cost the railway companies in the repair of damaged road and rolling-stock and in compensation for deaths and personal injuries, many times as much as the economies which will be effected by abstaining from making up all the lost time possible.



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Locomotive and Train Working in the latter part of the 19th Century.

THE GREAT NORTH OF SCOTLAND RAILWAY. [No. III.]

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

THREE similar engines, Nos. 12 to 14, were built in 1890 by R. Stephenson & Co., but the last three engines, Nos. 75 to 77, designed by Mr. Manson, and also built by the same firm, were notable in having 6 ft. 6 in. coupled wheels. These were the largest wheels that have ever existed on the Great North, and Nos. 75 to 77 are the only engines that have had wheels larger than 6 ft. 1 in. Another novel feature in these six engines was the adoption of an 8-wheeled tender, in which the leading end was carried on a four-wheeled bogie, and the four trailing wheels had rigid axles supported in ordinary axle-boxes.

Mr. Manson also placed in service the only engines with six-coupled wheels which the Great North has ever possessed. These were side tank engines having 4 ft. 6 in. coupled wheels, and 16 in. by 24 in. cylinders, and were built by Kitson and Co. as follows :—

1884 : Nos. 8, 11, 15, 16, 39 and 42.
1885 : Nos. 37, 38 and 41.

These engines worked the local passenger traffic to Culter and other suburban stations, in addition to shunting and banking work. As was usual with Mr. Manson's locomotives for the Great North, there was a simple but very useful novelty in them. Those who have ridden on tank engines in former years will remember the severe draughts which blew round the footplate, owing to the wind being caught by the bunker front and reflected back on to the men. To prevent this Mr. Manson fitted the new tank engines with simple hinged iron doors, which could be closed when running. I believe this was the first instance in which such footplate doors were applied, and Mr. S. W. Johnson,

Photo.] **4-4-0 LOCOMOTIVE, No. 13.** [*Loco. Publishing Co., Ltd.*

Designed by Mr. J. Manson, and built by R. Stephenson & Co., Ltd., 1890.
Coupled wheels, 6 ft. 1 in. diam. (Nos. 75–77 had 6 ft. 6 in. wheels). Cylinders, 18 in. by 26 in.
Provided with 8-wheeled tenders.

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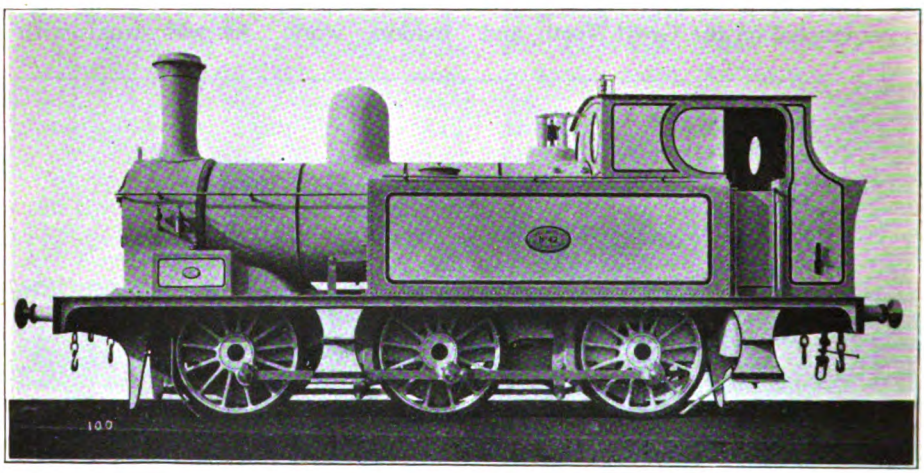
of the Midland, as soon as he heard of them, immediately fitted the whole of his 0-4-4 bogie tank engines with similar doors, and this simple improvement has now spread to many other railways and is also applied to tender engines.

The short account of Mr. James Manson's locomotive work on the Great North of Scotland Railway would be incomplete without some mention of his "automatic tablet exchanger" for single line working. The greater part of the Great North to the north of Gartly is single line, and as the improvements rapidly being made by Mr. Moffat included fast trains, stopping only at the principal stations, something



0-6-0 TANK ENGINE, No. 42.

Designed by Mr. J. Manson, and built by Kitson & Co., Ltd., 1884. Wheels, 4 ft. 6 in. diam. Cylinders, 16 in. by 24 in. These were the first engines to be fitted with side doors to footplate.

was necessary to allow of the exchange of the train tablets at high speeds. The apparatus was described and illustrated in the RAILWAY MAGAZINE of January, 1898, in an excellent article on this railway by the Rev. W. J. Scott, entitled "Little and Good," so that it is unnecessary for me to give more than an abridged description of it. The foundation of the system appears to have been derived from that used in letting out and taking in the mail bags from travelling post office sorting vans. A cast-iron post stands at the side of the line, just far enough back to clear the engine and train. On this are mounted two forks, for delivering and picking up the tablets to and from the engine. The receiving fork has strong prongs which face the approaching train, and the delivery fork has weaker prongs facing in the opposite direction towards which the train is travelling. On the engine is a similar exchanger with picking up and delivery forks attached to an arm, the latter fork being weaker than the other, and pointing backwards. The engine and the station forks are at a slightly different level so that they do not foul each other. The action is that, as the engine passes, the strong picking-up fork on the station platform catches a leather pouch containing the tablet which the engine is carrying in its reversed weak fork, whilst at the same time the strong fork on the engine picks up the new tablet pouch which is lightly held by the reversed weak fork on the platform. The arms on which the forks are fixed are made to slide in and out, and when extended are in the proper positions for making the exchanges of tablets at full speed. The arm on the engine can not only be drawn back as mentioned above, but can also be removed when not required. It is to the lasting honour of Mr. Manson, as Sir William Acworth relates, that he refused to patent this valuable invention, leaving it to be applied freely by any railway, in the hope that it would help to protect railway servants from the injury liable to occur with the old method of tablet exchanging.

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The locomotive works of the Great North were at this period at Kittybrewster, about two miles from Aberdeen. These works were much too small, and only about four engines could be accommodated in the erecting shop, in which all repairs had to be done. Much of the work had consequently to be done outside, and how Mr. Manson managed to find the space to build two new engines there in 1887, whilst the repairs were being done, is remarkable. Towards the close of the nineteenth century the company began the erection of their present new locomotive and carriage works at Inverurie, 16¾ miles from Aberdeen joint station, and these were opened at the beginning of the present century.

By 1888 considerable improvements had been made in the train services. The fastest trains were the two business trains between Ballater and Aberdeen, which ran at average speeds of 38–39 m.p.h., exclusive of stops. The best train on the north main line was the 10.10 a.m. up from Elgin, 87¼ miles via the Buckie or Coast line, the time allowed to Aberdeen being 2 hours 35 min. The speed, not including stops, was 35½ m.p.h., and inclusive of stops, 34 m.p.h. Making allowance for the long single line this was very good work. This train also made the longest run on the line, from Huntly to Aberdeen, 40¾ miles in 68 min., at the rate of 36 m.p.h. The time taken between these two stations 10 years before, in the shocking days of the Great North, had been 1 hr. 50 min. The 10.10 a.m. down from Aberdeen in 1888 reached Keith (53¾ miles) in 1 hr. 36 min., the speed, exclusive of stops, being 35½ m.p.h.

In 1891 the down morning express had been altered to 9.30 a.m. from Aberdeen, and although it stopped at Inverurie, Inveramsay and Insch, it reached Huntly in 1 hr. 13 min. This was a fast train throughout to Elgin, and ran in two portions from Grange. The part which ran over the old road via Keith arrived at Elgin at 12.13 p.m., and that via the coast line at 12.12 p.m. The 7 p.m. down express from Aberdeen ran via the coast line only and reached Elgin at 9·40 p.m., but detached coaches at Grange, which arrived at Keith at 8.40 p.m.

The former up 10.10 a.m. from Elgin, which now left at 10.15 a.m., had, however, been "decelerated" to the extent of 5 min. to Aberdeen, but nevertheless, made the through run from Huntly in 67 min, or 1 min. better than in 1888.

Peterhead also came in for what may be termed "fast" trains, that is, judged from the Peterhead point of view. True, the down train took 1 hr. 45 min. for the 44¼ miles, and made seven stops, but as Peterhead had never known much of fast travelling this was quite a "lightning express." Evidently Peterhead people were in a greater hurry to get to Aberdeen than they were to get home again, for the up fast train made 10 stops, but nevertheless managed to reach Aberdeen in 5 min. less time than did the corresponding down train with only seven stops.

On the Ballater line the 8.25 a.m. up business express, took 1 hr. 15 min. to reach Aberdeen with four intermediate stops. Its best non-stop run was from Crathes to Aberdeen, 14¼ miles, in 24 min. The corresponding 4.30 p.m. down express took 23 min.

In 1891 Mr. Manson left the locomotive department of the Great North for that of the Glasgow and South Western Railway, and was succeeded at Kittybrewster by Mr. James Johnson, the son of Mr. S. W. Johnson, of the Midland Railway, and the 15 engines which he placed in service in 1893 had a distinct Midland appearance. The Great Northern Stirling type of chimney introduced by Mr. Manson gave place to a style very similar to that of the Midland, and the Ramsbottom safety valves were replaced by the well-known Johnson brass column. The dome had safety valves on the top, but there were no spring balances. The motion was direct, but many of Mr. Manson's details were retained.

The six passenger engines, Nos. 78 to 83, have 6 ft. 1 in. coupled wheels, 3 ft. 9½ in. bogie wheels, and 18 in. by 26 in. cylinders. The firebox was somewhat larger than that of Mr. Manson's "18" and "75" classes, and provided 113½ sq. ft. of heating surface, the total heating surface being 1,207 sq. ft. The total weight in working order was 43 tons 18 cwt., and the boiler pressure 165 lb. per square inch. The six-wheeled tenders of these engines carried 3,000 gallons of water, had frames of the Midland pattern, and were larger than those of the "18" class. The engines were built by Neilson & Co.

The same firm also built Nos. 84 to 92,

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0-4-4 bogie side tank engines for the local passenger traffic in the Aberdeen area, on which these engines displaced the 0-6-0 tank engines of Mr. Manson's design. The "84" class had boilers exactly the same as those of the 4-4-0 engines, "78" class. The cylinders were 17½ in. by 26 in., the coupled wheels were 5 ft. 1 in. diam., and the engines weighed 53¾ tons in working order. They are the only four-coupled passenger tank engines of the type on the Great North of Scotland Railway.

Mr. Pickersgill succeeded Mr. Johnson in 1894, and his 4-4-0 engines followed the same general type, with the same dimensions for the boilers, but a return was made to the round-topped domes and Ramsbottom valves. The cylinders are 18 in. by 26 in., the coupled wheels have a diameter of 6 ft. 1 in., and the bogie wheels of 3 ft. 9½ in. The heating surface is 1,207 sq. ft., and the pressure 165 lb. per square inch. The engines of this class, Nos. 93 to 112 and 19 to 24, were all built by Neilson & Co. during the years 1895 to 1898, and were followed in 1899 by five more of the same class, 113 to 115, 25 and 26, in which the cabs were altered to the American type used on the North Eastern Railway, and a modification was made in the design of the splashers.

By the end of the century the Great North had succeeded in keeping on its own lines to Elgin practically nearly all the through trains between Aberdeen and Inverness, and the old Highland line between Keith and Elgin had lost most of the traffic, although this route is considerably shorter than either of the Great North lines. The Highland, however, had one up train which it ran to Keith over its own road, and gave the quickest time of 3 hr. 15 min. between Inverness and Aberdeen, but this was the one remaining relic of the days when the Highland controlled most of the through traffic via Keith.

The train service in the closing years of the century had again been improved, and some very interesting particulars of these improvements were given in another article by the Rev. W. J. Scott ("Bigger and Better") in the RAILWAY MAGAZINE for March, 1898, to which I recommend those readers interested in this railway to refer. Mr. Scott mentions that soon after the 1895 race from London to Aberdeen had brought the London trains into Aberdeen at about 6.30 a.m., the Great North started a 6.45 a.m., train thence to Elgin, which was due there at 9.15 a.m. But in the autumn of 1896 its numerous conditional stops were suppressed, and it was timed to cover the 87¼ miles to Elgin via the coast in 2 hr. 3 min. at a rate of 41¾ m.p.h. for a journey of which more than half was single line. The finest piece of work ever done on the Great North was the more than excellent run of this train from Aberdeen to Huntly, 40¾ miles in 45 min., at a speed of 54 m.p.h. The last seven miles were run over single line. Mr. Scott gave several timings, in which the booked speeds were greatly improved upon, and average speeds of 55·4 m.p.h. were attained. On the 10.32 a.m. up train from Elgin the run from Huntly to Dyce Junction, 34½ miles, was booked at almost 50 m.p.h., and was actually timed by Mr. Scott at 56½ m.p.h.

I must leave the "Great North" at this point, but before doing so I will return to Kittybrewster Works. On reading Mr. Scott's article, referred to above, after many years, I was very disappointed to have one of my treasured legends knocked on the head. It has followed into oblivion the story of the lady who sold Sybilline books to an ancient Roman monarch, and other terminological inexactitudes, such as were perpetrated by Livy, Herodotus and other historians. I had lived long with the rooted idea that Kittybrewster was named after a lady who had kept a bar in the district. Sir W. Acworth said it was a toll-bar, but that makes very little difference. But Mr. Scott's report is that the fair sex had nothing to do with the name, and that the first half of the word is merely a Gaelic prefix. As I know no Gaelic I must leave it at that, but it seems a pity that the Gaels came and interfered with the legend. If they had known much of the Great North of Scotland as it was in its early days they would have remained in their Highland glens.

Mr. H. Gordon Cumming, of Inverness, writes as follows:—I enclose a photograph (see next page) of one of the old engines (No. 34) as originally built. It was given

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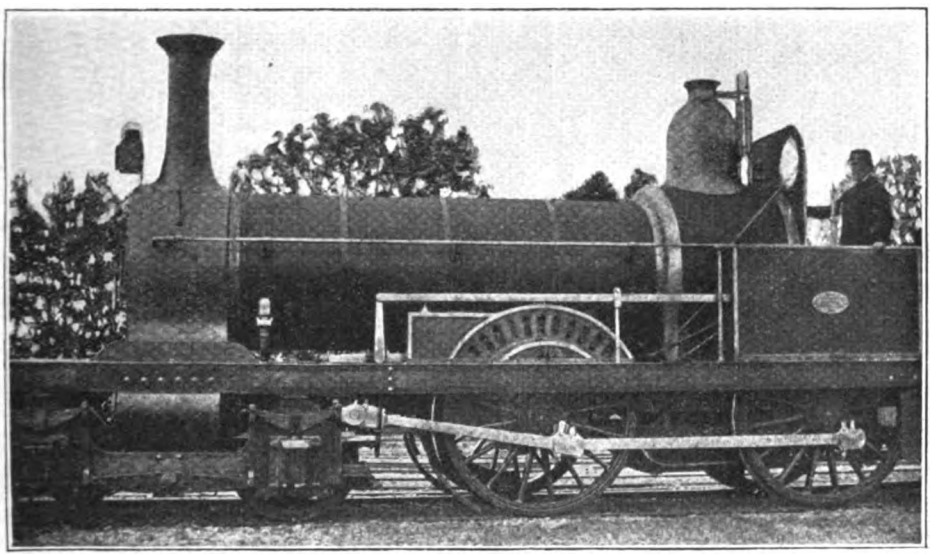
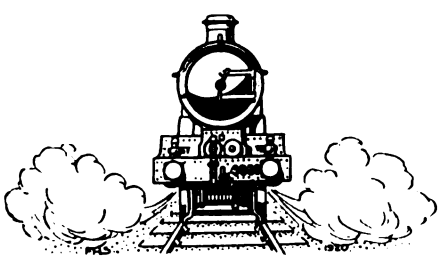
to me by its driver more than 50 years ago. The engine was one of those built by R. Stephenson & Co. in 1861, and all the traffic on the Keith–Elgin section of the main line, and also on the Speyside branch (between Craigellachie Junction and Boat of Garten) was worked by it and similar engines during the 'sixties and early 'seventies. The trains which they dealt with were all "mixed" in those days.

It will be noted that the bogie wheels had outside bearings and springs, etc., resembling in this respect Mr. Dean's Great Western Railway 7 ft. 8 in. "singles" at a much later date. I always understood that the coupled wheels were only 4 ft. 6 in. in diameter; they were not supplied with brakes, and the engines were, I think, never fitted with cabs. These engines were gradually replaced on the above sections of the line by a class somewhat similar, though of rather larger proportions, by Neilson, of Glasgow. Their coupled wheels were 5 ft. 6 in. diameter; the bogie wheels had inside bearings, etc., and were half covered by "splashers." No. 29, illustrated on page 58, January RAILWAY MAGAZINE, is of somewhat similar appearance, the cab, of course, being a later addition. In fact, at the period referred to, I think that none of the Great North of Scotland Railway tender engines were supplied with them, and the tenders were all four-wheeled. I believe that some of the Neilson engines, rebuilt, and with certain modern alterations and additions (including, of course, the Westinghouse brake apparatus which appears in your illustrations), are still, or were until recently, at work.



OLD 4-4-0 MIXED TRAFFIC LOCOMOTIVE USED ON KEITH AND ELGIN SECTION DURING 'SIXTIES AND 'SEVENTIES.



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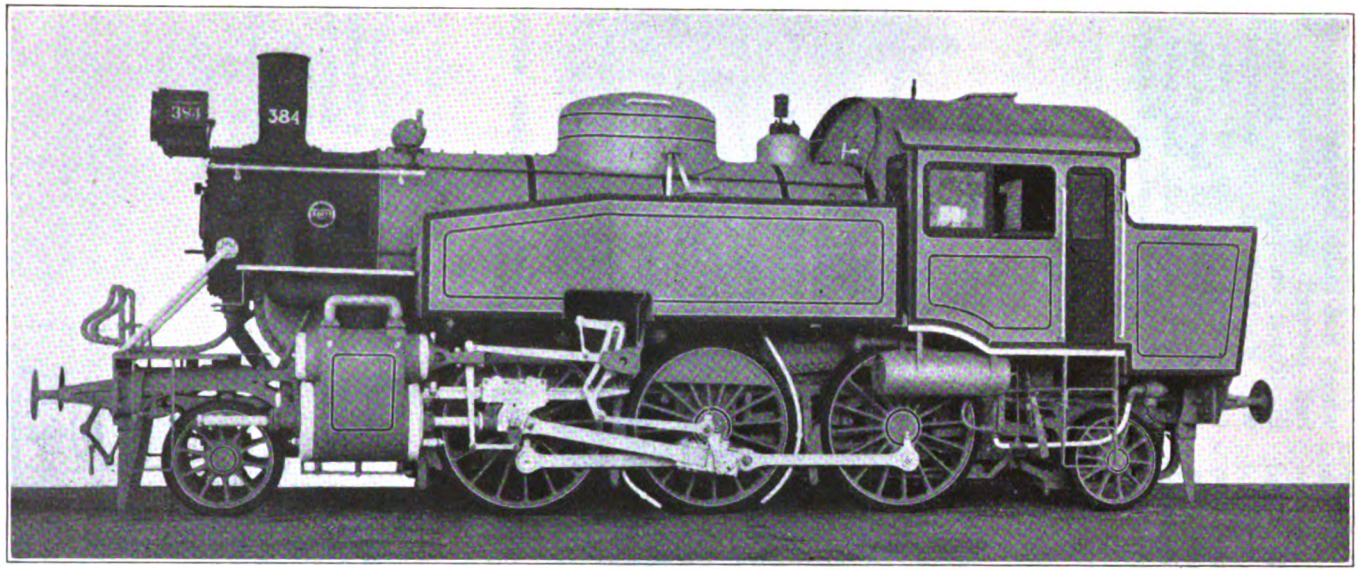
AMERICAN-BUILT 2-6-2 TANK ENGINE, NORWEGIAN STATE RAILWAYS.



BY the courtesy of Mr. R. P. C. Sanderson, London Manager of the Baldwin Locomotive Works, a 2-6-2 tank locomotive recently constructed for the Norwegian State Railways is illustrated. The boiler is equipped with superheating apparatus, and piston valves 9½-in. diam. are employed above the cylinders for steam distribution. The boilers are of steel, as also are the fireboxes, iron tubes being utilised. An interesting item in the equipment is the dynamo mounted upon the top of the boiler, immediately behind the smokebox, for supplying current for the electric headlight. Steam sanding is fitted on both sides of the driving pair of wheels for forward and backward running. The cab is of the totally enclosed pattern, with sliding windows at the sides. The bunker at the rear of the cab has a capacity of about 2¼ tons of coal, and the tanks together hold 1,928·6 U.S. gallons of water.

Leading dimensions are :

Cylinders, diameter	20¾ in. by 23·62 in.
Coupled wheels, diameter	5 ft. 3 in.
Heating surface—Firebox	92 sq. ft.
Tubes	907 ,,
Total ...	999 ,,
Superheater	233 ,,
Grate area	19·3 ,,
Working pressure	170 lb.
Weight in working order	65 tons.

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Shunting Locomotives on British Railways.

By J. F. GAIRNS, M.I.Loco.E.

EXCEPT by those who carry their enthusiasm in regard to the locomotive so far as to cover goods and shunting engines, as well as the admittedly more interesting classes used for high speed passenger train working, the lowly "switchers," as our American friends term them, are regarded as of little importance. Yet on any of the great railways the goods and mineral shunting mileage equals about two-thirds of the goods and mineral traffic mileage, representing the equivalent to several millions of train working miles, while "coaching" shunting involves large figures, though not so great proportionately as in the former case.

It is true that a considerable part of this work is done by road engines, either in the course of their ordinary work, or taking turns on shunting service, especially in the case of 0-6-0 tank engines and, to some extent, 0-6-2, 0-8-0, 2-8-0 and 0-8-2 locomotives of tank classes. It is, in fact, somewhat difficult to draw the line, in regard to engines of these types, between local goods and shunting service, as the same engines, or, at anyrate, the same classes, may be used in either field, and at times one engine comes under both headings in the course of its work. Neither, indeed, except with regard to four-wheeled engines, is it possible to differentiate closely, unless in respect of particular designs, as to whether they should rank as shunting or road engines.

But on every large railway the work performed by engines acting as shunters, whether designed expressly for that duty or not, figures very prominently in traffic operation, and the numbers of engines so employed daily reach high totals. In some instances, special designs have been introduced, and this applies particularly to 4-8-0, 0-8-4, 0-8-2 and 2-8-0 tank engines used in hump yards, where high tractive power and acceleration are called for. Usual requirements are, however, met by the ordinary local goods engines, particularly 0-6-0 and 0-6-2 tank locomotives, with instances here and there of 2-6-2, 2-6-4 and 0-8-0 engines so utilized. Locomotives of the two former classes are, therefore, to be found spending the whole of their days, usually double-, and frequently triple-crewed, breaking and making up goods and mineral trains, never going out on to the main line except to proceed to and from the engine sheds at the beginning or ending of a turn of duty, which is not unusually from Sunday night or Monday morning until the next Saturday evening.

The classes mentioned, with 2-4-2 or 0-4-4 tank engines taking turns on passenger train shunting, deal with the larger proportion of the shunting work of a great railway, in goods yards, marshalling sidings, docks and elsewhere (carriage sidings and big terminal or junction stations also in the case of passenger train shunters), besides doing the heavier work associated with railway workshops, stores, &c. There are, however, many duties which call for smaller engines, and on most railways 0-4-0 locomotives are also in use, these being designed for use in yards where curves and other factors render the 0-6-0 engines unsuitable, or where the duties can be more conveniently met by a reasonably powerful though small locomotive of this type. As will be seen very powerful four-wheeled locomotives are in use on several lines, partly to meet requirements in locations where 0-6-0 engines cannot be employed for various reasons, and in other cases because they can do all that is needed and are not required to travel at speeds above about 10 m.p.h. or to perform work under running conditions.

It is interesting to note that engines intended for or suitable for use as goods shunters total about half of the total tank engine stock in the case of British railways as a whole. According to recent statistics there were no fewer than 302 0-4-0 tank engines, which can only be

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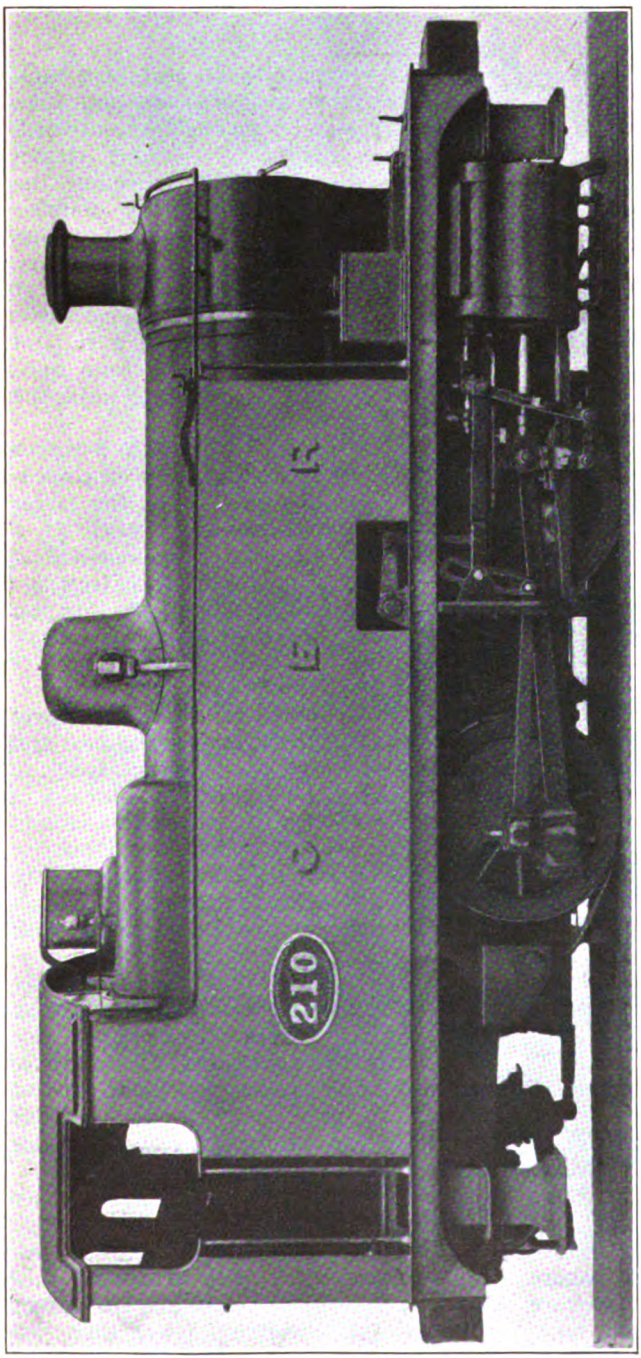
used for such duties; 3,707 of the 0-6-0 type include large numbers engaged solely on shunting work, as also in the case of 1,490 of the 0-6-2 type, and some of other six-coupled types; and of the eight-coupled locomotives four of the 0-8-4 type, 11 of the 4-8-0 type, and many of the remaining 180 (2-8-0, 0-8-2 and 0-8-0) spend much, if not all of their time on similar work.



0-4-0 OUTSIDE CYLINDER SHUNTING TANK ENGINE, GREAT EASTERN RAILWAY.

Considering 0-4-0 locomotives only, there are few large railways which do not possess them, as the following particulars in regard to the principal users indicate:—Caledonian Railway (46), Glasgow and South Western Railway (10), Great Eastern Railway (12), Lancashire and Yorkshire Railway (62), London and North Western Railway (17), London and South Western Railway (31), Midland Railway (33), North British Railway (38), North Eastern Railway (24). On other lines the totals are below 10. In the case of the Lancashire and Yorkshire and London and North Western Railways narrow-gauge engines used at the respective works are included, but most, if not all, of the others are of standard gauge, used about works, to serve iron and steel establishments where the railway performs shunting but the curves preclude the use of larger engines, in docks, and to some extent in railway yards and goods depôts where 0-6-0 locomotives cannot or need not be employed.

In design there is not usually anything very distinctive, except for cases where great power within severe limits and the need for using four wheels only have given the designers a difficult problem. Most have outside cylinders, many have the water tanks carried as a saddle over the boiler, though this is by no means so

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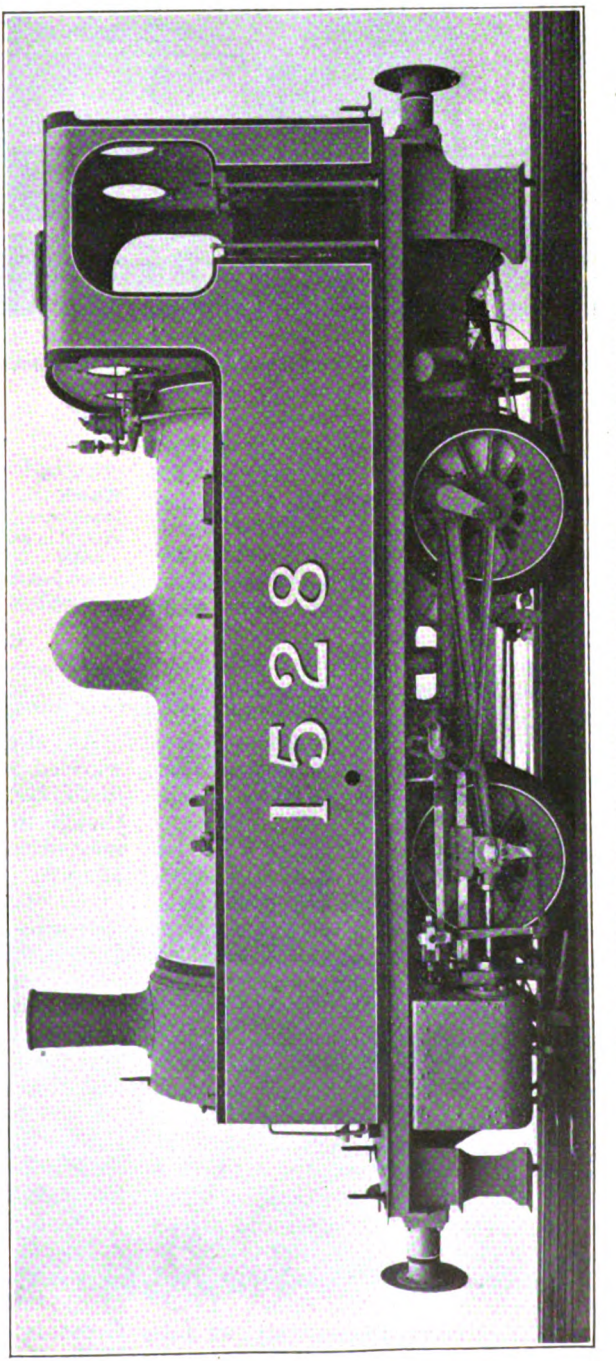
generally characteristic of railway-owned four-wheelers as of contractors' locomotives, and the bunker is usually conspicuous by its absence, coal in small but sufficient quantities being carried elsewhere, as a coal stage is always within easy reach.

Putting aside the diminutive narrow-gauge engines used at Crewe and Horwich works, most of the four-wheeled shunters in use accord more or less with the usual standards of the railway concerned. Their boilers may be the same as those of smaller 0-6-0 classes, as a greater overhang is allowable and there is no bunker load to carry. Under many conditions, however, small dimensions are insisted upon, and this accounts for the continuance of designs which appear to be out of date. For use in docks and on harbour lines, for example, there may be swing bridges which prohibit the axle load being increased and sometimes small dimensions are necessary to allow the engines to pass under low bridges or where space is restricted. In a few instances the engines have low chimneys, and in other cases, as on the London and North Western Railway about the Liverpool docks, the engines are oil-fired to avoid spark-throwing. Here and there they may be seen fitted with cow-catchers at each end, while it is by no means unusual to find them provided with spark-arresting chimney caps and with bells to herald their approach where public roads are crossed on the level or perhaps traversed for some distance. There are also designs which are cased in and the motion shielded in order to satisfy official requirements where the lines pass along public thoroughfares. Locomotives of these classes are, too, in several instances, equipped for condensing the exhaust steam.

Many of these special requirements may be regarded as called for by the



0-4-0 OUTSIDE CYLINDER SHUNTING TANK ENGINE, MIDLAND RAILWAY.

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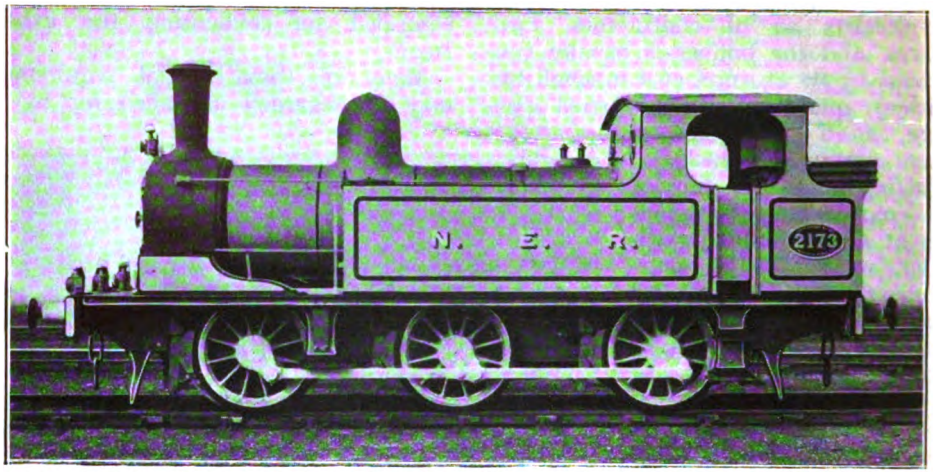

0-6-0 SHUNTING LOCOMOTIVE, NORTH EASTERN RAILWAY.

nature of the work done by the engine rather than incidental to their service as shunters, though they are interesting to record. For actual shunting duty, however, the general need is for considerable power within restricted dimensions, seeing that not infrequently they must be almost as powerful as six-coupled engines, though the latter are precluded because of the sharpness of the curves to be traversed. Two examples of recent practice in regard to powerful 0-4-0 engines are illustrated, respectively, on the Great Eastern and Midland Railways.

The former is a development of 0-4-0 engines used at Stratford Market, Devonshire Street, and other yards where larger engines cannot be employed, and they have also been adopted at Stratford Works to meet load requirements beyond the capabilities of the small 0-4-0's previously used. The Midland engine is designed for similar work, and particularly with regard to requirements at Derby, though it is a somewhat smaller engine. Both are, however, powerful machines for their type. In each case Walschaert valve gear is fitted as being more convenient for oversight and attention, while the Great Eastern engine has a Belpaire firebox and top feed water supply through the dome. Leading dimensions are respectively as follows :—

	G.E.R.	M.R.
Cylinders ...	17 in. × 20 in.	15 in. × 22 in.
Wheels	3 ft. 10 in.	3 ft. 9¾ in.
Wheelbase ...	6 ft.	7 ft. 6 in.
Weight in working order	38 tons. 1 cwt.	32 tons 16 cwt.
Steam pressure ...	180 lb. per sq.in.	160 lb. per sq.in.
Heating Surface—		
tubes	905·4 sq. ft.	692·5 sq. ft.
firebox	75·1 ,, ,,	58·25 ,, ,,
total	980·5 ,, ,,	750·75 ,, ,,
Grate Area ...	13·9 ,, ,,	10·5 ,, ,,

As already indicated six- and eight-wheeled engines can rarely be classified distinctively as shunting or road engines, though in regard to particular classes this may often be done. In regard to designs adapted to meet special requirements many of the remarks already made as to four-wheeled classes equally apply, as, for example, in respect of oil-firing, condensing, provision of spark-arresters, cow-catchers and enclosing casings, bells and restriction of dimensions. There are also such familiar classes as the London and North Western Railway saddle-tank 0-6-0 engines, so well-known all over the system, which are restricted very closely to shunting. On most railways, however, the 0-6-0 engines seem to be used almost indiscriminately as shunting or local goods engines, as on the Great Western Railway (mainly the ubiquitous saddle-tank class), Midland Railway, Great Northern Railway, Great Eastern Railway, and other lines. In other

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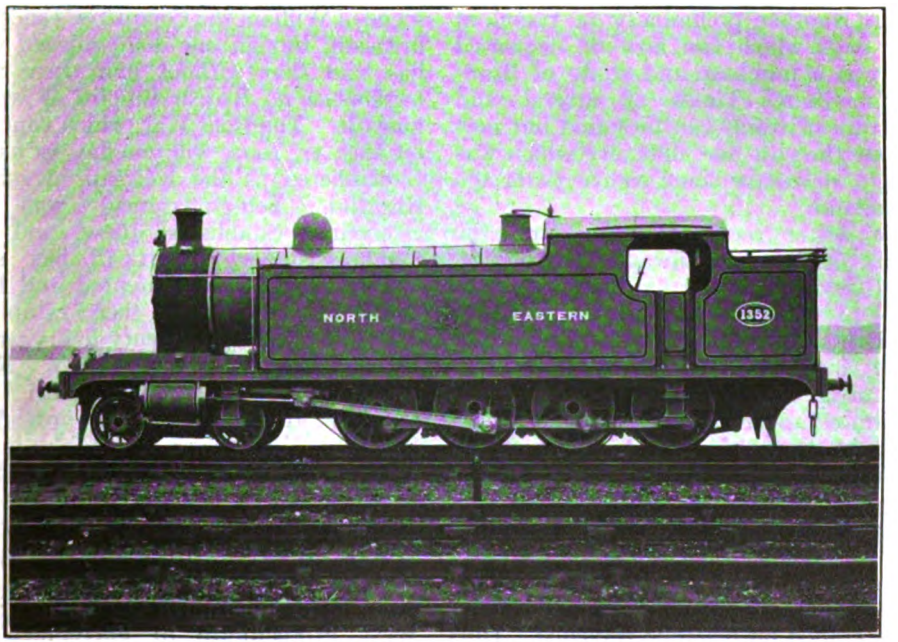
instances, however, there are 0-6-0 engines which are distinctively intended for service in yards, docks, &c., notably on the London and South Western and North Eastern Railways. The special classes, which frequently include wheels close together to give a short wheelbase, are shunters pure and simple, and as a rule are of moderate dimensions as a matter of necessity. The alternative shunting or road classes, on the other hand, are often of considerable power for their dimensions, and their general adaptability allows of their combining shunting and pilot duties as needed.

It may be noted that the following railways have more than 100 engines of this type, allowing for all classes of work, passenger or goods, road or shunting, given to them: Great Western Railway (1,100), Midland Railway (355), London and North Western Railway (293), Great Northern Railway (265), Great Eastern Railway (258), North Eastern Railway (258), Lancashire and Yorkshire Railway (243), Caledonian Railway (200), North British Railway (132). Many have saddle tanks, particularly on the Great Western and Great Northern Railways, but the general tendency now is to carry the water in side tanks.

Other six-coupled engines used for shunting are generally of the same classes as those employed for local goods work and call for little attention, especially as they can hardly be considered statistically either on the basis of goods or passenger service, or for road or shunting duties. In the case of eight-coupled engines the special types, such as 4-8-0 and 0-8-4, were introduced mainly for hump yard work, shunting of a special type, and many of the 0-8-0, 0-8-2 and 2-8-0 engines are similarly utilized, though they also do much heavy shunting on ordinary lines, and in some places work mineral trains under running conditions. In the case of hump shunters large cylinder power (three cylinders in some designs) and boilers capable of meeting heavy but intermittent demands are provided, the engines being of notable design as a whole. Other eight-coupled engines accord more with corresponding tender engine practice, but in tank engine form, and, therefore, suitable for either heavy shunting or for heavy local goods traffic.



THREE-CYLINDER 4-8-0 "HUMP" SHUNTING TANK ENGINE, NORTH EASTERN RAILWAY.

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An Anglo-Indian on South African Railways.

By N. P.

WHILST all countries with civilised Governments seem to have considered that railways are necessarily the best means of communication between places on land, and a virtual necessity for good administration, there appear to be great differences of opinion as to the system on which they should be run, and whether in temperate or tropical climates it will usually be found that they differ considerably. Perhaps the best has yet to be evolved. There have been great improvements in the British Islands since railways were first established nearly a century ago, when third-class passengers were carried in open trucks like sheep, exposed to the weather whatever it happened to be, in a climate one of the most variable in Europe. This did not last long, and the most numerous and most profitable class of passengers soon obtained better treatment. Another preliminary of travel in early days which can now be dispensed with was a purchase and study of Bradshaw's Guide. Times of arrival and departure of trains can be found out now without the cost and difficulty which was thought necessary some eighty years ago in England.

The writer recently came across the South African Railways timetables, which give in two languages the most complete information of the kind of any British possession, and until further notice this valuable work, as well as an Illustrated Hotel Guide for Africa, is distributed gratis to all who ask for it. Not only can one learn the cost of travelling in every part of Africa where there is a railway, but the height above the sea of every station is also given. The distances are enormous, but facilities are given by the railway authorities in South Africa for obtaining circular tickets, the fares being graded on distance travelled. Thus a first-class ticket for 2,020 miles costs £16 3s., for 2,520 miles £18 11s. 3d., for 3,040 miles £20 8s. 6d., for 3,560 miles £22 1s., and for 4,200 miles £24 1s. The names of a great many stations will recall to many the days of the Boer War and the hardships experienced by many thousands of our soldiers in following up a brave and experienced foe, who though largely outnumbered was able to keep hostilities going for three or four years before giving up the fight. There must still be many hundreds of survivors of those times, though their ranks were largely diminished by the still deadlier war of 1914-18. Our railway stations in England, to those who recall the history of their country, are often close to battlefields. They were, however, fought centuries ago and are mostly forgotten at the present time. People going to Hastings, for instance, at the present day mostly think of it only as a pleasant summer watering place and seldom give a thought to its having been the scene of William the Conqueror's successful invasion, though one distinguished writer has said that without him there would have been no British Empire as we now know it. The Boer War, which concluded on May 31, 1902, will one day be as little remembered as the Norman invasion of England. Self-government was soon afterwards established there, and their loyal assistance in 1914-18 has shown that the Boers are contented and happy under the new *regime* there established. They were thought twenty-five years ago to be bigoted and unprogressive. Recent events and even these new South African Railway time-tables have proved the contrary. With these time-tables is given a large standard railway map of South Africa, recently revised and photo-lithographed at the Government Printing Works, Pretoria. It is about 3 ft. by 2 ft., and shows the whole country from the Atlantic to the Indian Ocean, the South-West Protectorate to Portuguese East Africa, and in the north beyond Matabeleland and Rhodesia. In native territories

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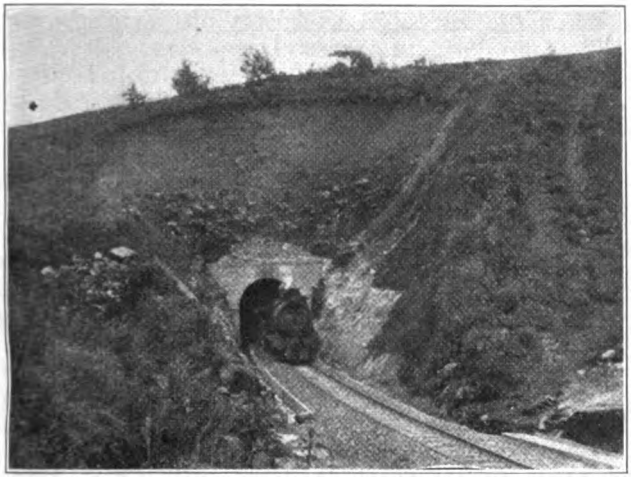


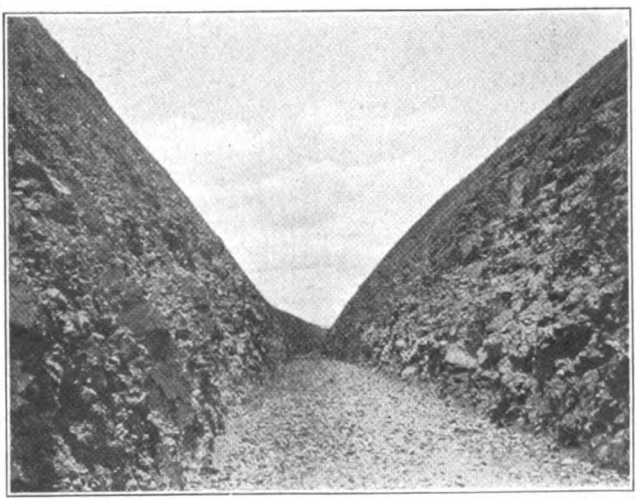
CEDARA TUNNEL.

Teteleku–Cedara Line, north of Pietermaritzburg.

where there are no railways it is stated that motor cars are available costing approximately 2*s.* per mile.

To those with money and time at command there could hardly be a pleasanter way of getting a complete change than a visit to South Africa. The Hotel and Boarding House Guide has many beautiful illustrations, both of town and country. There is one of Rhodes' grave at Matapos, several of the Victoria Falls, Rhodesia, and many pages of others in all parts of South Africa. The charges at hotels and boarding houses vary from 6*s.* 6*d.* a day upwards, moderate enough when living rates in Europe are considered. Railway travelling in Africa does not seem to have suffered either from coal shortage or strikes as has been the case at home and in our Indian possessions.

Very little thought is bestowed at the present time on the debt which not only India but the British Empire owes to Dalhousie, the last of the Governor-Generals of India, who was the statesman who, recognising the importance of railways, was the first to introduce them in our vast dependency out there. Our Indian railways led to the successful invasion and occupation of Mesopotamia, which could never have been accomplished, as it was in the late war in so short a time, without them. Dalhousie, who had served first as Vice-President of the Board of Trade under Mr. Gladstone and afterwards as President, knew and did appreciate their value. In the year 1845 he had passed, after personal study, 332 railway projects involving a capital of 271 millions, besides several foreign schemes which had appealed to English capitalists. At the last day for lodging applications 600 new schemes were deposited in his office. To him more than any other single man Great Britain and India owe their railway systems. But he was over-worked. and at the Board of Trade sowed the seeds of that disease which eventually carried him off in the prime of life and made it impossible for him to complete the usual five years' term of service as Governor-General of India. He recorded what a bitter pang it was to him to be so ill as not to be able to accompany the first railway



ETHELVALE CUTTING.

Pentrich–Manderston Deviation, part of a large scheme of new construction to avoid the heavy gradients, frequently 1 in 30, of the original lines in Natal.

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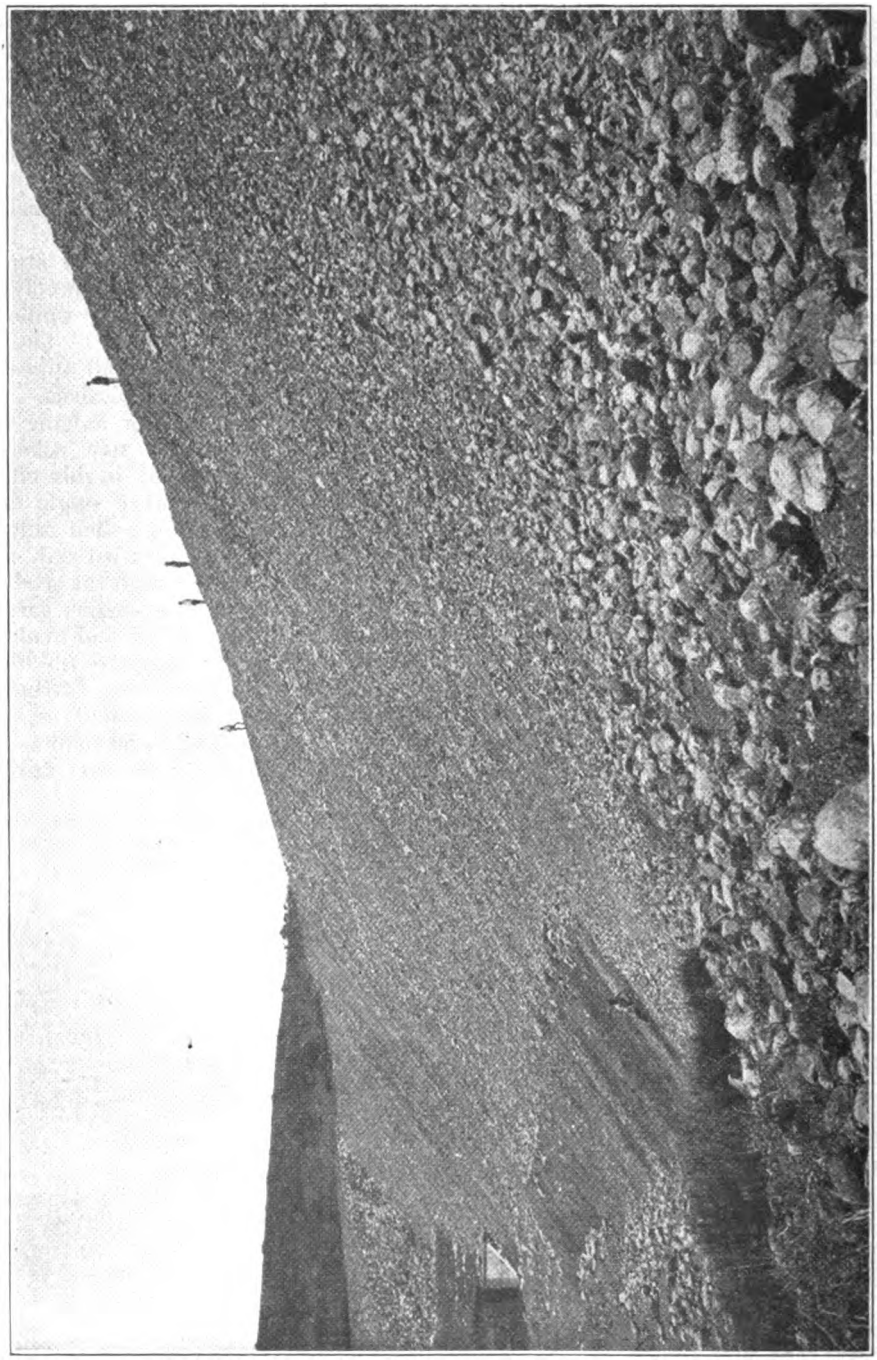

COGWENDI BANK, PENTRICH-MANDERSTON DEVIATION, NATAL.

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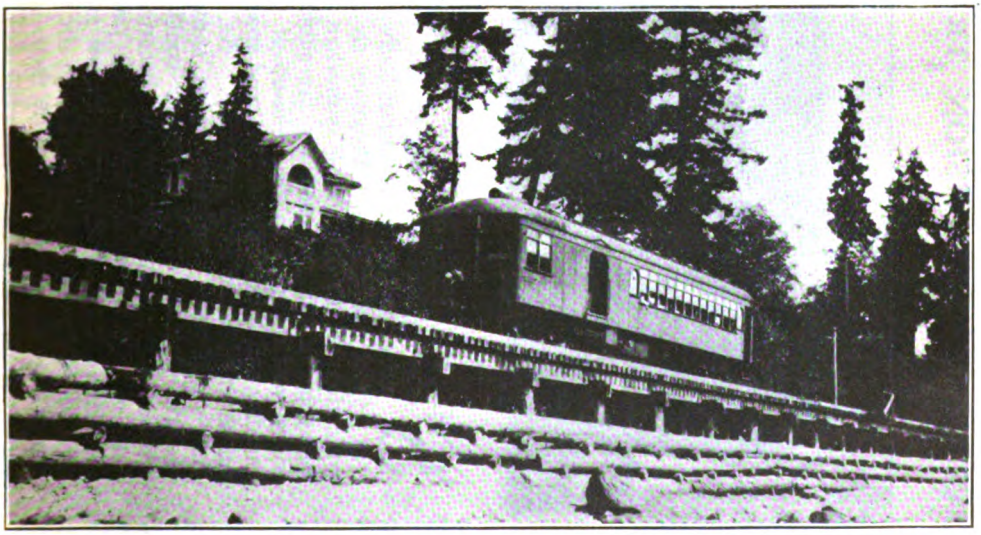
train which he had officially sent on its journey Bombay-wards from the suburb opposite Calcutta, and when he was dying in England and was told of the eulogy his successor had passed on him when opening an extension of the railway in another direction, he smiled, saying, "I always knew Canning was a gentleman."

Close upon seventy years have passed since Lord Dalhousie passed away, the inaugurator of Indian railways. We have never had a Viceroy who took greater interest in them or who has displayed greater knowledge in their advantages to India. There are different opinions amongst both officials and non-officials as to the system under which they should be worked, and perhaps the recently-established self-government reform may bring about some desirable improvement. We would notice that in South African territory they would seem to appreciate the value of publicity to a much greater extent than in India. You cannot buy in the latter country the information which in the former is distributed free of charge. In most Indian provinces they sell time-tables of the running of trains for one or two annas each, but these only refer to the lines in the particular province where they are sold. This procedure may be right or wrong from a pecuniary point of view, but it is certainly more inconvenient for tourists and travellers.

Travelling in our overseas possessions is undoubtedly a good thing, and the more we know of our South African fellow subjects the better should we understand them and be able to appreciate their many good qualities and the way they came to our assistance in the recent Great War of 1914-18.

There are few things equal to travel as a means for increasing knowledge and diminishing those feelings of contempt and prejudice which sometimes prevail amongst races which know little of each other. The more civilised races see of each other the more they will find to respect and imitate, for no nation holds a monopoly of all human good qualities. The South African Government is therefore acting wisely in giving as much publicity as it can in encouraging travel and distributing as widely as possible the information it possesses regarding its splendid system of railway accommodation throughout its vast territories and those adjoining them, which are of wide interest to all civilised communities.



Photo]. **PACIFIC GREAT EASTERN RAILWAY.** [*C. J. K. Littlebury.*

Petrol Motor Car No. 101, running between North Vancouver and Whytecliffe. The photograph was taken near Hollyburn, British Columbia.

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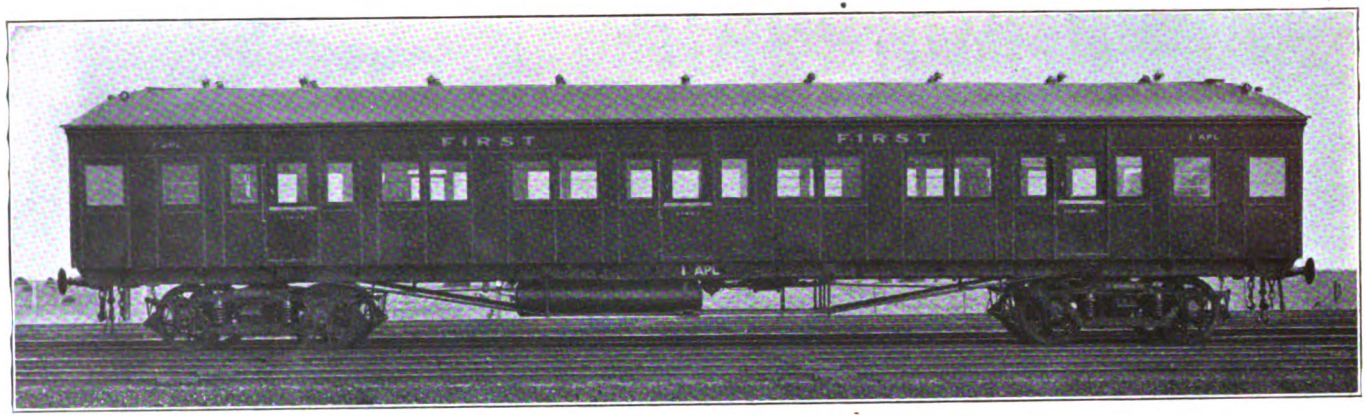
CARS FOR EXCURSION TRAFFIC, VICTORIAN GOVERNMENT RAILWAYS.



SIXTY-EIGHT of these carriages are in service, and a further 80 are under construction at the Victorian Railways' Newport workshops. Previous to the electrification of the Melbourne suburban railways, passenger carriages used for the suburban services were included in the make-up of trains for Sunday and holiday excursions, and special traffic on short distance lines generally. As, however, this stock was gradually being converted to electric traction, and therefore could not be utilised for steam services, it became evident that other stock would have to be provided in its place. As the steel underframes and bogies of the suburban steam stock, to be used as motor coaches, were replaced by those of heavier construction, the released material was used for the manufacture of the new carriages. The body, to some extent, follows the latest design for the suburban carriages by having sliding doors in place of swing doors. The suburban electric carriages have sliding doors for each compartment, but the new excursion carriages have three main saloon compartments with one door only to each side of each compartment. The main compartments consist of one smoking and two non-smoking.

The carriage seats 82 passengers, this being the same capacity for either first or second-class carriages. A lavatory is placed at each end, adjacent to a small semi-private compartment, that at one end being reserved for ladies only. Communication from end to end is by a central gangway, with doors between each section.

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New Electric Rolling-stock, North Eastern Railway.

AT the York carriage shops of the North Eastern Railway work has been proceeding in connection with the building of new passenger vehicles of various types to replace those destroyed in the disastrous fire which occurred at the car depôt at Walker Gate-on-Tyne on August 11, 1918. At this fire the whole of the sheds forming the storage and running accommodation were totally burnt out in about one hour from the time the fire was discovered, and 34 vehicles, consisting of 19 motor and 15 trailer coaches, were destroyed.

This was a serious loss to the railway company, and necessarily an inconvenience to the public, as the electrified lines in the Newcastle district serve a thickly populated and very busy business and residential district, in addition to which the holiday traffic to the sea coast was very heavy at the time.

The question of replacing the stock was immediately taken in hand by the management, and by the courtesy of Sir Vincent L. Raven, K.B.E., Chief Mechanical Engineer of the North Eastern Railway, we are able to illustrate and describe the new stock now being placed in traffic. The new vehicles embody the principal good features of the existing Tynemouth electric stock, but include several new ones, such as standard form of semi-elliptical roof, improved type of electric-chandelier and other improvements.

Trains consist of coaches arranged on the multiple-unit system, the numbers of motor and trailer coaches being normally equal. The original motor control equipment employed is known as the "semi-automatic type." This will not be extended or continued in future; the new "X" control equipments are designed for use with hand notching controllers with series parallel operation of the motors on the "bridge" principle, and for remote control circuit breakers in the motor circuit of each coach. The existing coaches will be converted for operating in trains with the new equipments.

The following list gives the numbers and types of coaches upon which the York carriage shops have been engaged in connection with the stock requirements:—

2 motor composite vehicles	...	Double driving.
5 motor composite vehicles	...	Single driving.
5 motor third-class vehicles	...	Single driving.
7 motor third-class vehicles	...	Double driving.
15 trailer third-class vehicles	...	Non-driving.

In addition to the above, a new parcels van—double driving—has been introduced for the heavy milk and fish traffic. This vehicle is fitted with four motors—one to each axle—and is capable of hauling several other vehicles as trailers; these consist of ordinary stock such as six-wheeled covered vans, open fish trucks, &c., comprising a trailing load of 70 tons.

The whole of the electric equipment has been supplied and installed by the British Thomson-Houston Company, Rugby, and was fitted to the stock at the carriage shops of the North Eastern Railway Company at York. The stock is fitted with pressed steel bogies of strong design, the motor bogies being specially reinforced where the bogie crossbars are attached to the sole-bars, this being found necessary from practical experience gained with the original stock. Each coach is fitted with one motor and one trailer bogie, the motor bogies being equipped with two G.E. 254 B. motors rated at 140 b.h.p. geared on to a solid spur wheel pressed on to the axles, the gear ratio being 3·64 to 1. All bogies on the motor coaches are fitted with collector shoes and ice scrapers, and the motor bogies are fitted with sandboxes at all four corners, which can be operated from the driver's compartment by means of a valve, which is coupled up to the brake train pipe.

The motor and trailer bogies each have a wheelbase of 7 ft., and are fitted with rolled steel disc wheels 3 ft. diameter on tread, having highest quality acid open-hearth steel tyres 5 in. by 2½ in,. which are shrunk on to the centres and secured by Gibson's retaining rings, and as a further

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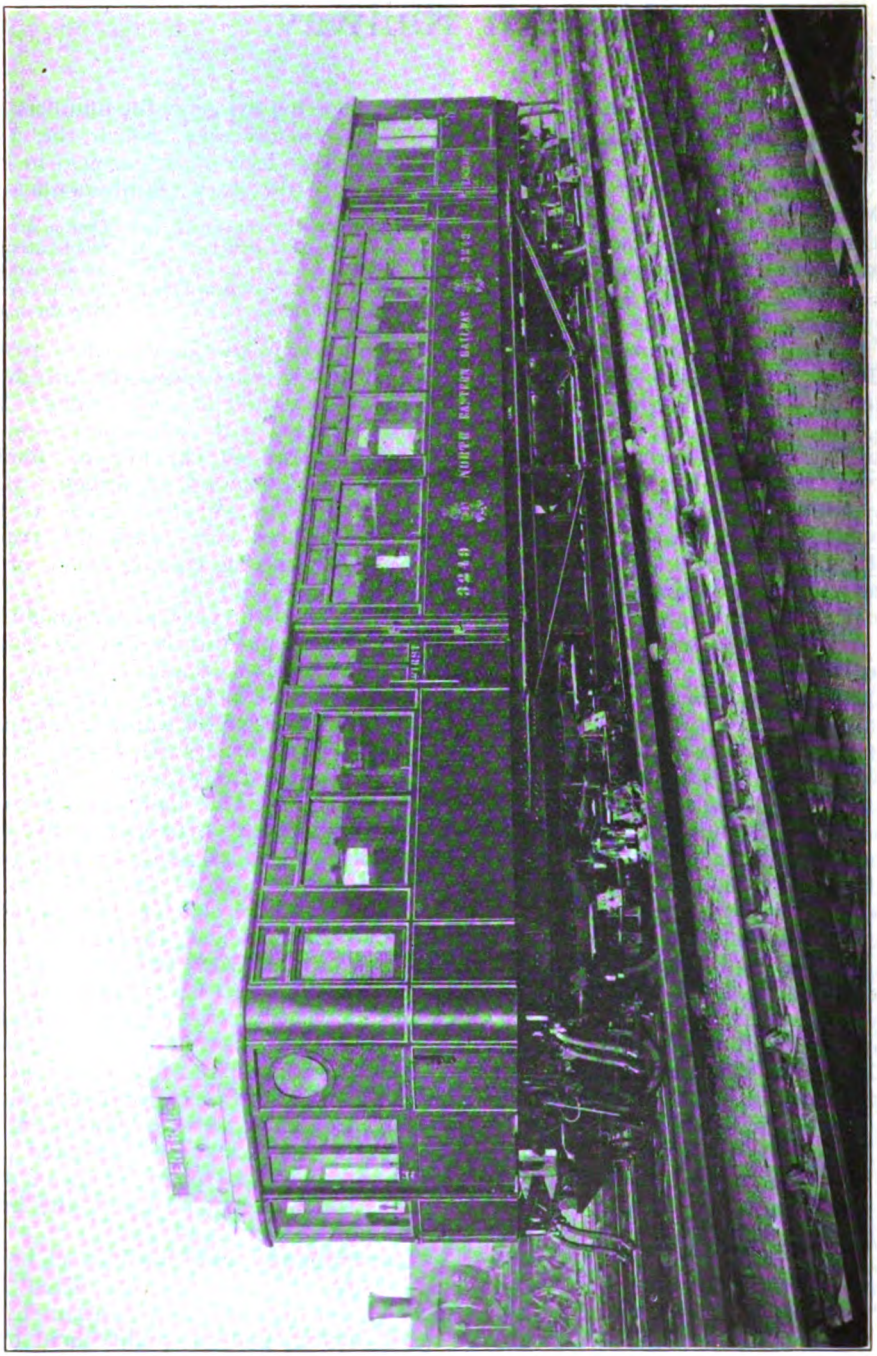

SINGLE-DRIVING MOTOR COMPOSITE CAR.

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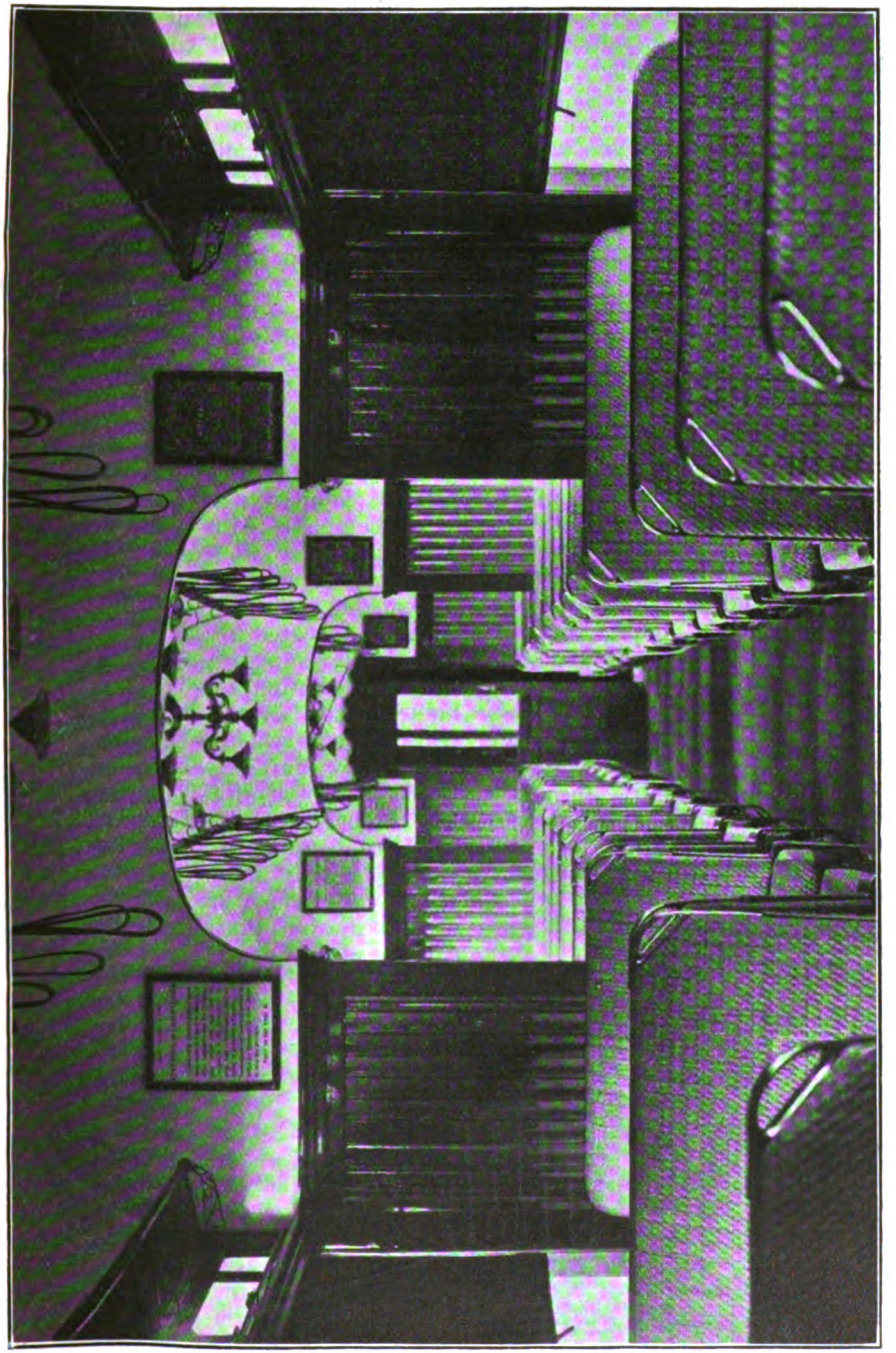

INTERIOR OF THIRD-CLASS TRAILER CAR.

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precaution against loose tyres, and to secure additional safety, eight set screws are tapped into each wheel centre with a good projection into the tyres. The underframes are of steel throughout, and although light are very strong; this is obtained by means of good deep trusses and cross-braced queen posts.

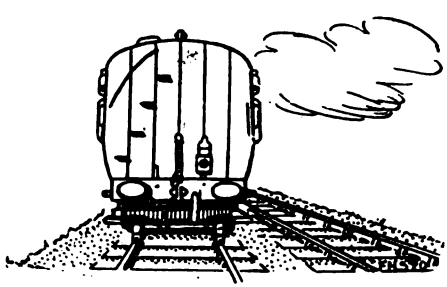
The standard six-coach trains are designed so that at the less busy part of the day they can be divided, the four-coach portion comprising a complete unit.

Double-driving motor composite cars are capable of seating 48 passengers. There are three main passenger compartments, with luggage, two vestibules and two driver's compartments complete. The smoking compartment seats are upholstered in blue cloth, as are also the reversible seats in the non-smoking compartment. The floors of these two compartments have linoleum laid upon the cement, which, in turn, is covered with a removable carpet. The large passenger compartment is known as a "convertible compartment," the class indicator boards being reversible "first" and "third," and are arranged so that they can be locked with whichever class it is desired to show. This enables the first and third-class accommodation to be regulated to suit the needs of the service. The seats in this compartment are upholstered in green buffalo hide, and the floor covered with linoleum. The whole of the interior finish is in oak up to the cant rail height, hygienic casing boards being used. The roof, which is double cased, is covered inside with ¼-in. plain millboard painted white.

First-class compartments are finished in mahogany treated in a similar fashion to the convertible compartment, the roof also being similarly dealt with. All compartments are fitted complete with net racks for light luggage and parcels, straps for strap hanging, and electroliers of a pleasing design in brass, the net rod brackets, door handles, etc., being also in brass. The seats are reversible. The exteriors of the coaches are finished in crimson lake, the North Eastern standard colour, and in this respect a slight departure has been made from past practice, as the electric stock colour has previously been cream and vermilion.

The driver's compartment is complete in every respect, including large switch panel, controller, brake and sand operating valves, etc. It is also electrically heated and is provided with a seat for the driver. Each luggage compartment on these trains is fitted complete with fire-fighting appliances and first-aid requisites.

Double driving motor third-class cars are capable of seating 64 passengers. The interior is treated in the same way as the convertible compartment previously described, excepting that the floor has no linoleum laid on the cement, whilst the seats are covered in "Ratan," the latter being very durable and hygienic. The whole of the seats in this car are reversible, but those adjacent to the ends and partition are secured in order to make the seating slightly more commodious. The trailer cars, which are similar as regards internal finish to the motor thirds, are each capable of seating 72 passengers.



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British Locomotive Practice and Performance.

By CECIL J. ALLEN, A.M.Inst.T., A.I.Loco.E.

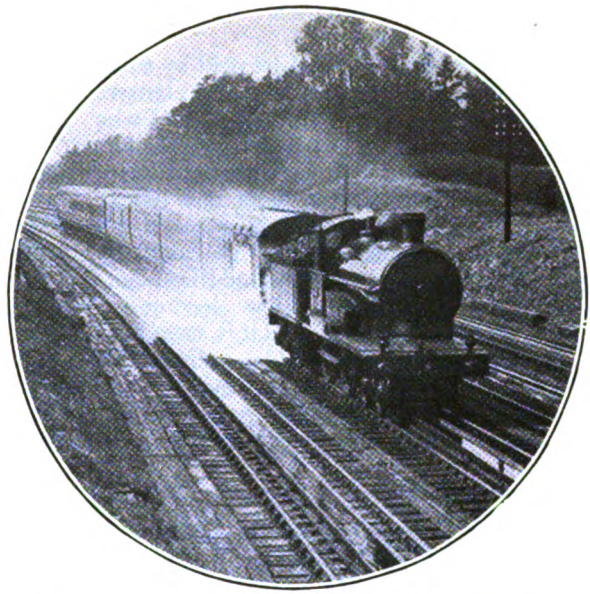

Photo.] [*Leslie J. Thompson.*

LONDON & NORTH WESTERN RAILWAY.

Up two-hour Birmingham-London Express.
4–4–0 superheater engine, No. 226, "Colwyn Bay."
Taking water at Castlethorpe troughs.

CONTINUING the discussion of letters received from correspondents, which occupied the "Practice" space of my February article, I have now a further batch of communications awaiting attention. In connection with the subject matter of the article in November last, an enquirer, citing the remark that "the whole object of the locomotive designer of to-day is not to build the smallest engine that will succeed in performing the work required, but rather an engine with an ample reserve of power," asks enlightenment as to the continued practice of some British railways in building or employing comparatively small locomotives to work their traffic, the instance which he adduces specially being that of the Midland Railway. There are, of course, many more aspects of this subject than the one to which I confined myself in the article in question.

It is not every company that is free to build engines of exceptional power, even though it might be desirous of doing so. In the British Isles we suffer the disadvantage of having pioneered in railway construction, and some railways in these islands, planned in the past without the slightest conception as to the future increase in the weight and speed of the traffic destined to pass over them, would be put to an unthinkable expense were they at one operation to undertake the task of strengthening all the underline bridgework sufficiently to carry in safety the giant locomotives of their neighbours. As the bridges come up for renewal they are so strengthened, in the great majority of cases, but this must of necessity be a gradual process, and two or three bridges only of insufficient carrying capacity in any main route are enough to ban the use of heavy engines over it. There are several British companies still badly handicapped in this way. I believe that such considerations apply to a limited extent on the Midland Railway, but, at the same time, in regard to express passenger traffic, the general working principle of the latter company—that of operating a frequent service of moderately loaded expresses, rather than an intermittent service of very heavy trains—doubtless has not been without its influence on Midland express locomotive practice.

There is yet another consideration bearing upon present-day locomotive building; it is a point stressed in an able paper read recently by Mr. J. F. Gairns before the Institution of Locomotive

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Engineers. Regard must be paid by those companies who are the most extensive builders of new locomotive stock, and who are aiming, in as great a degree as possible, toward standardisation of construction, to the fact that, as the older and lighter engines now in service wear out and are scrapped, their places must be taken by some of the machines now building (short of the construction of new locomotive stock for special duties), and it is, therefore, desirable that considerable numbers of engines of moderate dimensions and weight shall be available, suitable for service over practically all sections of the future, of a regiment of "Princes" is beyond dispute.

The same could not be said of the "George the Fifth" 4-4-0's, magnificent as has been much of the work to their credit. They are heavier on their driving axles than the "Princes," and therefore slightly more restricted in their sphere of action; they are also, when pressed, bigger coal-burners, and their lower adhesion, as compared with the six-coupled engines, makes them a more easy prey to bad weather conditions. The limited capacity of the "Georges" was brought home to me forcibly the other night, in

Photo.] FURNESS RAILWAY. [*F. E. Mackay.*

Barrow-Carnforth train worked by 4-6-4 tank engine, No. 119.

systems concerned. To such a policy may be traced, for example, the numerous additions of "Prince of Wales" class 4-6-0 engines to the express locomotive "stud" of the London & North Western Railway—a "maid-of-all-work" species of machine that is capable of almost any kind of haulage, from the fastest and heaviest main-line duties downwards. Probably an engine of this type, when really "opened out" in order to maintain a fast schedule with a very heavy train, will consume more coal than a four-cylinder 4-6-0 "Claughton" on the same duty—it is only to be expected—but the general handiness, both present and returning from Manchester to London by the express due in Euston at 8.10 p.m. An engine of this type was provided to work up from a Crewe a 60-axle train weighing 438 tons empty and at least 465 tons full, and not unnaturally failed in the attempt to keep time. We took 78 min. 35 sec. instead of 73 min. for the 61 miles from Crewe to Nuneaton; having left Crewe 7¾ min. late, we left Nuneaton nearly 13 min. late, and so were stopped outside Rugby for the 6.20 p.m. Birmingham-London two-hour express to clear; then, after a p.w.r. slack between Rugby and Kilsby, we ran the 69·9 miles from Welton to Willesden in 75½ min.—a fine

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performance, indeed, with the engine hauling fully 8·4 times its own weight, but not enough to prevent us from reaching Euston 28½ min. behind time.

Such an occurrence as this is amply sufficient to prove why the "Georges," as a type, are not being perpetuated. For myself, I greatly wished that I had come up by the competing Midland 4.35 p.m. train, which would have given me a later start by 25 minutes, and half-an-hour's earlier arrival home. Not that the Midland is always free from reproach, however. On a recent trip with the 12.20 p.m. from Manchester to St. Pancras, a superheated

Photo.] HIGHLAND RAILWAY. [*A. B. Noble.*

Southbound train at Stochd summit, detaching pilot. Train engine 4-6-0, No. 27, "Thurso Castle"; pilot goods 4-6-0, No. 106.

class "3" 4-4-0, with 228 tons tare, instead of the specified time-table maximum of 180 tons, lost 7¼ min. from Cheadle Heath to Derby, while a rebuilt and superheated class "2," with exactly the same excess of actual over specified load, from Derby to London, lost 2 min. (net) between Derby and Leicester and 6¾ min. thence to St. Pancras, where we arrived 12½ min. late, 4½ min. having been economised by smart station working at Derby and Leicester. These were both clear cases of overload, of course, neither the suitable classes of engines nor pilots being available.

This brings me directly to my second letter. "It seems to me," says the writer, commenting also on the November article, "that the London & North Western Railway is the line which illustrates better than any other the point at issue, viz., that small engines can, within reasonable limits, perform the work of large ones when necessary. What I cannot see, however, is this: Why, if such large numbers of 'Claughtons' are available, does one still find 'Georges' hauling the heaviest trains at times, while all three classes—'Claughtons,' 'Princes' and 'Georges'—seem to work indiscriminately on each and every express? If the 'Claughtons' are designed for economy with heavy trains, why are not these trains marked down, as on the Great Western Railway, for haulage by a 4-6-0? By contrast, there is a stopping local train from Birmingham to Sutton Coldfield, which is worked almost every day by a Crewe 'Claughton.' Again, the two-hour Birmingham trains are being worked almost entirely by 'Princes,' even though some of the loads are only five bogies; would not such trains prove ideal for the larger-wheeled 'Georges'?"

In examining these points, let us bear in mind, first, that, owing to the continued shortage of locomotives—after at least

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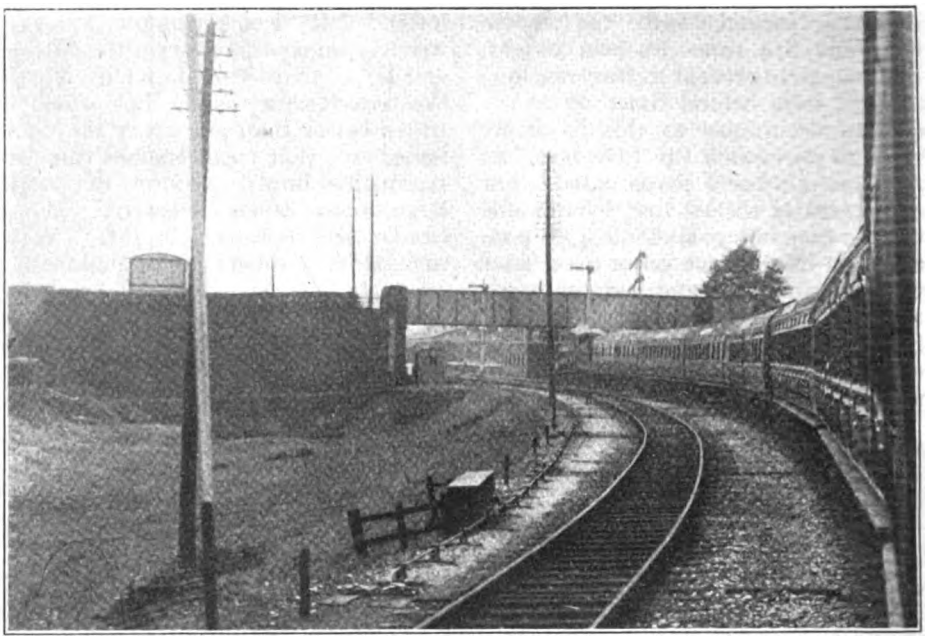

Photo.] GREAT WESTERN RAILWAY. [*Norman Rodger.*

Down "Cornish Riviera" express approaching Westbury. Photograph taken from a window of the train while in motion.

three years' arrears of construction, arising out of war conditions, and by no means overtaken yet—and also in consequence of the eight hours' day, it is necessary to get the maximum possible in each day out of both engines and crews. This will explain the presence of the "Claughton" on the Sutton Coldfield branch, and other apparently unimportant duties; it is simply filling in with useful work a brief space of time between other more important turns. Secondly, an engine must obviously be worked back to its own shed within the 24 hours, if reasonably possible, even though it may not return with the crew with which it started out, and herein lies the inherent difficulty of confining particular engines to particular duties.

A "George the Fifth," working a five-coach train from Birmingham to London, say, might not be at all sure of a corresponding duty on the return journey, or might have an inordinate wait in order to secure it, which, for reasons just previously explained, is both economically unsound and at present impossible. For all that, since the reinstatement of the 2-hour timings, a number of "Georges" have been drafted to this service, in order to work, as far as possible, the lighter trains, to which, as my correspondent rightly claims, they are admirably adapted; at the same time, I believe it is the intention to work the hardest trips, such as the 6.55 p.m. down, with "Claughton" class engines. In his first contention my friend is not altogether correct, as efforts certainly are made on the London & North Western Railway to confine the most difficult main-line workings, such as the very heavy day Scotch expresses from London throughout to Carlisle, and other similar trains, with "Claughtons." The trouble is, however, that on this line, which throughout the year can show considerably the largest number of express trains daily made up to 50 axles and more, there are not yet enough of the big engines to "go round"; hence the anomalies to which my friend refers.

Further than that, as "accidents will happen in the best-regulated families," it not infrequently happens that an engine is laid up unexpectedly as requiring some major or minor repair, in which event the first "spare" engine handy—be it a "Prince" or a "George"—must take the turn of duty. In this connection, as

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my correspondent holds up the Great Western Railway as a model in this matter, on my last journey from Birmingham by the Great Western Railway route, owing to the failure of a 4-6-0 "Star," we were horsed, on the hardest trip of the day—the 2.55 p.m. up—by a 4-4-0 "County." The work performed on this run, described in the February issue, was, except on starting, barely distinguishable from that of a six-coupled engine, and considerably astonished me; but it is unquestionable that the smaller engine was being "extended" a good deal more than the "Star" would have required.

There now follow several letters containing criticisms as to the limited scope of the performance described in these articles. Here is the first indictment. "The writer of 'British Locomotive Practice and Performance' never seems to meet with work which is thoroughly discreditable; or, perhaps, he takes care not to record it." Possibly the two instances given earlier in the present article, on the Midland and London & North Western Railways, by the way, will help to rehabilitate my unfortunate reputation in this matter! "On Monday, January 10, 1921," the letter goes on, "I travelled to London by the East Coast Scotch express, due at King's Cross at 7 p.m. The train was so heavy that every locomotive man between Edinburgh and London must have known that no one engine of either company could work it properly without assistance; yet no pilot was provided. At York the train was three-quarters of an hour late, and the Great Northern 'Atlantics' then did so badly that it was after 8 p.m. when we finally reached London. I remembered travelling by the same train exactly 44 years before, in January, 1877. The time of arrival was then also 7 p.m., but there was then the 20 minutes' wait for luncheon at York. Time was lost in shunting into the old station at the same place, and there was no automatic brake to allow of free running. Thus the express of 1921 was appreciably slower than that of 1877, and to bring passengers in more than an hour late on such slow timings was a disgrace to everybody concerned. I think runs such as this should occasionally be shown up in the RAILWAY MAGAZINE."

The writer of this letter has completely misconceived the scope and purpose of these articles. Matters connected with the working of traffic, be that working good, bad or indifferent, are only introduced in

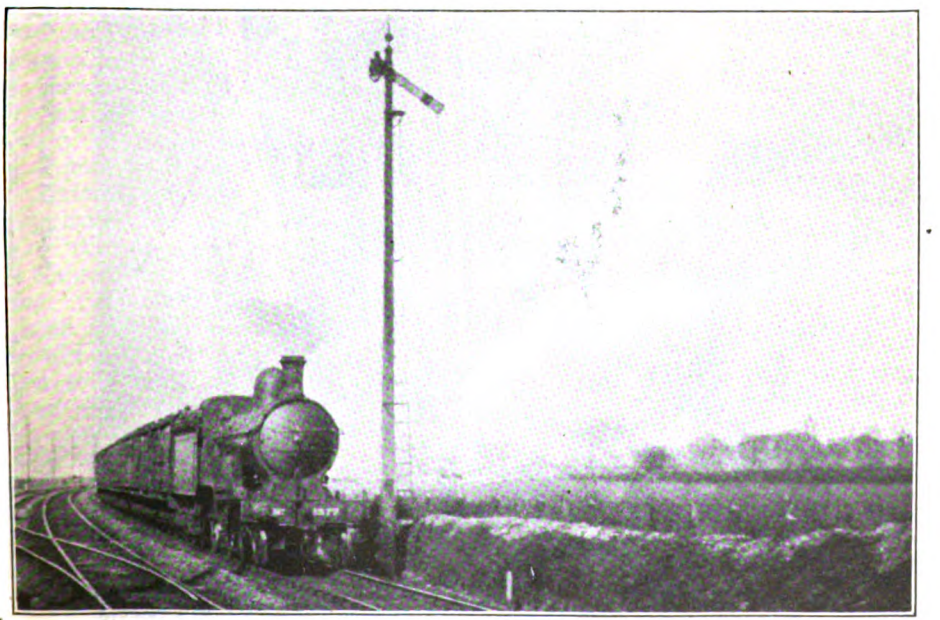

Photo.] GREAT NORTHERN RAILWAY. [*G. H. Cannon.*

Up train from Cambridge passing Trumpington Box, G.E.R. 4-4-0 locomotive, No. 1377.

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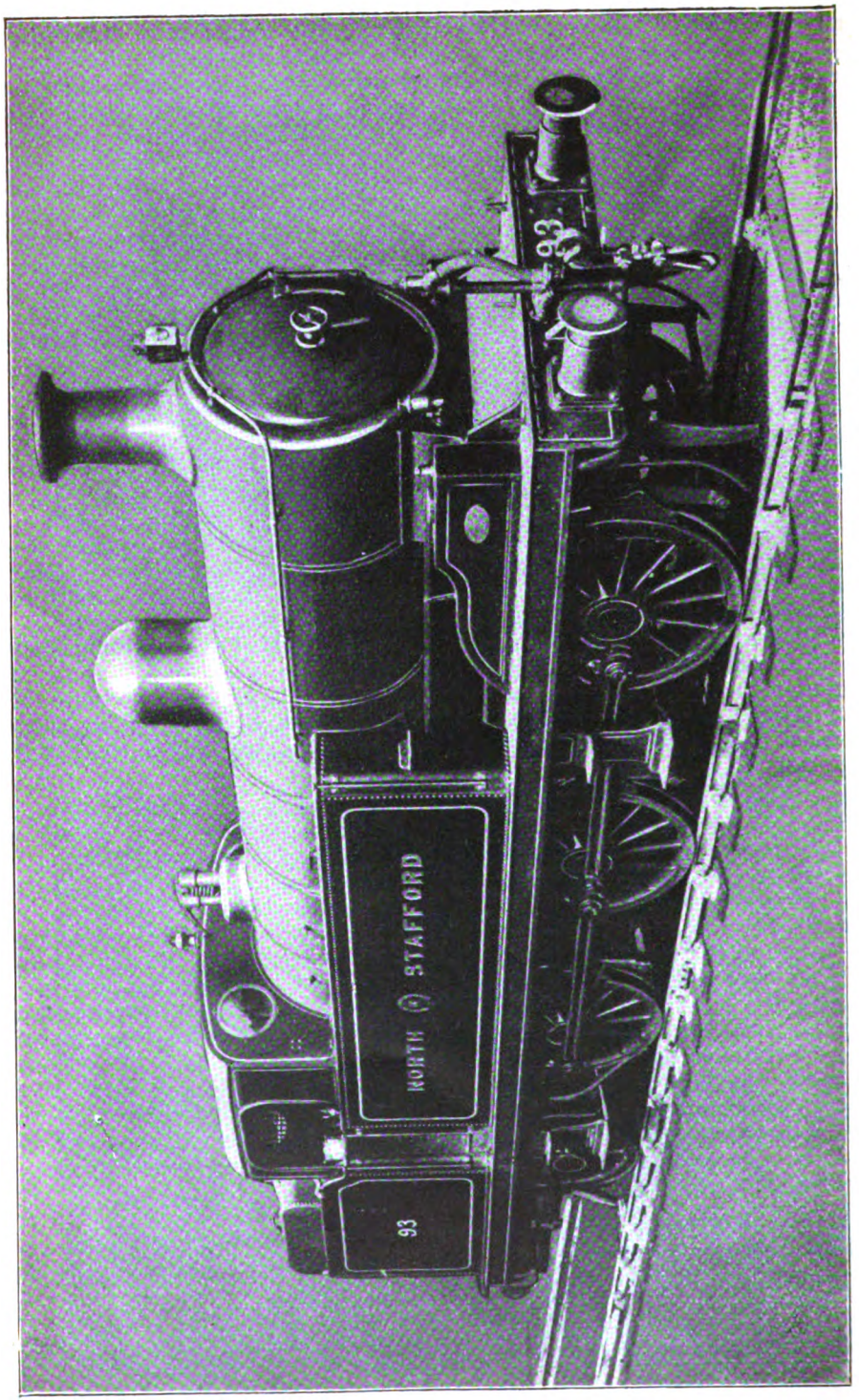

0-6-2 TANK ENGINE No. 93, NORTH STAFFORDSHIRE RAILWAY.

Fitted for burning Oil Fuel. Cylinders: 18½ in. diameter by 26 in. stroke. Coupled Wheels, 5 ft. diameter. Steam pressure, 175 lb. per sq. in. Heating Surface:—Tubes 1011·7 sq. ft. Firebox, 108·3 sq. ft. Grate Area:—17·8 sq. ft. Water capacity of Tanks:—1,700 gallons. Weight in working order:—59 tons, 15 cwt.

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so far as they, in their turn, affect the working of the locomotives. Had I travelled by the train in question, and considered that the performances of the engines in circumstances of difficulty had been good—what the load actually was, my correspondent does not state—I should not have hesitated to publish the run, no matter how much time was lost. But let it be always remembered that the title of this article is not "Express Train *Time-keeping*," but "British Locomotive Practice and *Performance*."

Another correspondent of many years' standing expressed an intention some time ago of tackling me on the same subject, and when I wrote him recently, inviting a commencement of the attack, he apparently took fright, and replied in a singularly mild fashion as follows:—"You say you are looking forward to rending me in pieces on the matter of your giving 'star' rather then average performances in the RAILWAY MAGAZINE. Well, much as Daniel would like to dominate the lions, I think this time he will, after mature consideration, stay on the other side of the bars, and be content merely to poke in his umbrella. The said umbrella consists in the remark that, in the case of routes over which you do not travel frequently yourself, but depend to a certain extent on correspondents, there is a tendency to publish more good than average performances. The Great Western Railway and London, Brighton & South Coast Railway will serve as good examples. But I can supply your defence myself—that, of course, correspondents do not generally send you logs of dull average time-keeping, but only those that 'would take a lot of beating,' 'one of the finest runs that I have ever seen recorded,' and the like, so that you could not give average figures if you wanted to." Taking the Great Western Railway as an example, my friend then proves that, whereas the Great Western Railway runs described by me in three different articles, with an average train load of 340 tons, show an average gain of 2.9 min. to locomotive, his own fairly extensive series of runs over the same line, with an average of 316 tons, shows a *loss* of 1.3 min. "Some of my runs," the letter continues, "were very good; others distinctly feeble; the latter kind do not get into the RAILWAY MAGAZINE. But I do not really think that the accusation would hold good of routes which you constantly use yourself. I am sorry," the letter concludes, "that the lions have to put up with so small a meal."

A very small meal indeed, especially as my line of defence is quite different to that which my friend appears to expect. Even as regards routes which I use frequently, I admit the charge. In the first place, my rail mileage during the three years subsequent to the Armistice alone, the vast bulk of which I have recorded in my note-books, so far as the locomotive work is concerned, has been in the neighbourhood of 135,000. During 1921 the actual figure was 50,725 miles. If I were to describe *all* these runs, the indulgence of an already patient Editor would be stretched to the extent of conceding me the exclusive use each month of a RAILWAY MAGAZINE about double the size of the present journal. Apart entirely from that consideration, however, I am bound to ask this question. Of what interest is it to the great majority of readers to know that an inefficient driver or an engine out of condition succeeded in losing so many minutes on such-and-such a schedule? Running of this character offers no real measure of the capacity of the engine or type concerned, and, therefore, has not the slightest value as scientific fact. I repeat with all emphasis that this is not an article expressly devoted to showing how the time-tables of the different railways are observed. It is, on the contrary, a *causerie* designed to discuss the dimensional and constructional features and illustrate the performance of the various locomotive types current on British railways. Steam engines, of whatsoever type and kind, whether locomotive or stationary, are always tested and technically rated on the basis of their maximum capacity. Consequently, in describing the locomotive performance of this country, it has always been my practice to describe the best runs I have available, as affording the truest estimate of locomotive power. On lines where my journeys are comparatively few, as my friend points out, I have, like every other random observer, to take what comes, and to record it, whether good, bad or

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L. & N.W.R. LONDON—BIRMINGHAM.

2.30 p.m. up		12.45 p.m. up.			Train.		9.10 a.m. down.		11.30 a.m. down
Schedule.	63 4-6-0(*a*) 32 222 235	Schedule.	501 4-6-0(*b*) 22 157 165	Distance.	Engine No. ,, Type Load (axles) ,, (T. tare) ,, (T. full)	Distance.	Schedule.	1691 4-6-0(*b*) 42 305 330	Schedule.	1730 4-4-0(*c*) 28 201 210
Min.	M. S.	Min.	M. S.	Miles.		Miles.	Min.	M. S.	Min.	M. S.
100	*91 30	99	96 55	94·0	Euston	0·0	0	0 00	0	0 00
	p.w.r.		*p.w.r.*							
92	sigs.	91	89 30	88·6	Willesden ..	5·4	9	9 55	9	8 55
—	†84 15	—	—	87·8	Milepost 6½ ..	—	—	—	—	—
—	82 10	—	87 02	85·9	Sudbury ..	8·1	—	12 45	—	11 35
—	79 25	—	84 12	82·6	Harrow ..	11·4	—	16 25	—	14 55
—	77 50	—	82 30	80·7	Pinner	13·3	—	18 40	—	16 55
—	75 25	—	79 54	78·0	Bushey	16·0	—	21 40	—	19 40
80	74 10	79	78 35	76·5	Watford ..	17·5	22	23 05	22	21 05
—	71 25	—	75 33	73·0	King's Langley	21·0	—	26 40	—	24 35
—	68 45	—	72 33	69·5	Boxmoor ..	24·5	—	30 20	—	28 15
—	66 00	—	69 35	66·0	Berkhamsted ..	28·0	—	34 05	—	32 05
65	62 25	65	65 52	62·3	Tring	31·7	37	38 05	37	36 10
—	58 00	—	61 16	57·9	Cheddington ..	36·1	—	42 15	—	40 20
—	54 05	—	57 25	53·8	Leighton ..	40·2	—	45 35	—	43 55
49	48 15	49	51 20	47 3	Bletchley ..	46·7	51	51 15	51	49 45
								p.w.r.		
—	43 15	—	45 57	41·6	Wolverton ..	52·4	—	57 30	—	55 25
—	41 25	—	43 58	39·3	Castlethorpe ..	54·7	—	60 10	—	57 45
36	37 10	36	39 22	34·1	Roade	59·9	64	66 00	64	63 20
—	34 30	—	36 20	31·2	Blisworth ..	62·8	—	69 05	—	66 20
—	28 25	—	29 35	24·3	Weedon.. ..	69·7	—	75 50	—	73 10
—	23 35	—	24 15	18·7	Welton	75·3	—	81 45	—	79 20
—	15 40	—	*p.w.r.*	12·0	Clifton Road ..	82·0	—	88 45	—	86 15
13	14 35	13	12 45	11·4	Rugby (*d*) ..	82·6	87	89 25	87	86 55
—	13 30	—	11 55	10·8	Rugby No. 7 ..	83·2	—	90 15	—	87 50
—	7 15	—	6 10	4·9	Brandon ..	89·1	—	96 00	—	93 30
0	0 00	0	0 00	0·0	Coventry ..	94·0	pass	pass	99	98 30
22	21 20	19	19 10	18·9			98	100 35	0	0 00
—	17 00	—	15 40	15·4	Tile Hill ..	97·5	—	104 35	—	5 50
—	15 00	—	13 45	13·4	Berkswell ..	99·5	—	106 50	—	7 55
—	11 50	—	10 48	10·1	Hampton ..	102·8	—	110 00	—	11 00
—	8 40	—	7 43	6·5	Marston Green	106·4	—	113 25	—	14 10
—	6 05	—	5 15	3·8	Stechford ..	109·1	—	116 00	—	16 50
—	3 20	—	3 10	1·9	Adderley Park	111·0	—	117 55	—	18 45
0	0 00	0	0 00	0·0	New Street ..	112·9	120	121 20	23	22 20

(*a*) 4-cylinder "Claughton" class. (*b*) 2-cylinder "Prince of Wales" class (name *Pathfinder*). (*c*) "George the Fifth" class (name *Snipe*). (*d*) Service Slack, 40 m.p.h.

* *Net* time of arrival. † Stop, signals.

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indifferent; but on lines over which I travel often, I shall certainly continue to pick the best of my runs, rather than the average, for description in these columns.

And then, as if to illustrate the way in which the unfortunate *littérateur* has constantly to steer between the Scylla of one line of criticism and the Charybdis of another, as soon as I have formulated the argument immediately foregoing, I receive a letter from a young gentleman *ætat* 17, who, after having "read a dozen or so back numbers," lays down emphatically "I think that Mr. C. J. Allen should devote more time to practice and give *only the best run over each route.*" The italics in the quotation are mine! From another correspondent, apparently in both age, assurance and conversance with the subject matter of these articles, equal to the writer of the foregoing, there comes a more weighty charge. "I and many others," I read with some concern, "would welcome a change in the subject of your timings," the particular change indicated as necessary being the work of tank engines and goods engines.

As regards tank locomotives, the real facts are that the letter-writer reads and bases his judgment on about a dozen or twenty articles out of a series which, so far as I have been responsible, reaches with this particular article a total of 141, and in which the work of practically every tank engine type that engages in fast passenger work, with one or two exceptions only, has from time to time been described. To one particular line referred to in his letter, entirely tank-engine operated, I devoted nearly a whole article in the early stages of the war, and I have refrained purposely from any subsequent mention, in that the times over this route were substantially increased immediately afterwards, and have never since been restored, although the average loads are no heavier than they were; indeed, most of the chief expresses are lighter than they were on their crack timings. Performance of tank engines on ordinary suburban trains is of little or no interest to the majority of readers, as the constant starting and stopping not only affords an engine no opportunity of showing its capabilities under continuous steam, but also sets the driving practice itself in so cast-iron a mould that the time-table is as accurate an indication of the running as detailed timings would be.

The work of goods locomotives, and more especially those engaged on express goods work, which get a reasonably clear road, is another matter. In this connection I reproduce herewith extracts from another letter—a letter of a type that it always gives me special pleasure to receive, in that it comes from an actual locomotive man. "I have often wondered," the letter runs, "why the goods engines seem to be neglected; some of these engines appear to me to do smarter work at times than their faster sisters. Since I first started to read your articles, I have seen some of the Midland No. 3 Class 0–6–0 goods engines perform some praiseworthy feats. On various occasions when we have had late starts I have got my mate to 'let the engine go' to see what she really could do, and what surprised me was the amount of power that she held in reserve, as you argued in your November article. Some of our runs are, for goods trains, timed very fast, such as from Leeds to Birmingham, 115 miles, in 4 hours 18 minutes, including two stops for water and examination. Then again there is a though express goods from Leeds to the G. and S.W. line, covering the 113 miles over Ais Gill summit into Carlisle in 4 hours 55 minutes; but so much are these engines master of their work that day after day their time of arrival does not vary by more than 5 minutes."

This interesting letter raises a point which has been in my mind for long enough—occasional timing of selected express goods trains, by permission of the responsible authorities—but the matter is not so easy as it may appear. The greater difficulty of working goods as compared with passenger stock, both in the matter of journal friction and increased atmospheric resistance (due to short as opposed to long vehicles, trains of irregular formation, and the absence of vestibules) is likely to affect the running to such a degree as to give comparatively an under-estimate of the performance of the goods engine, when we contrast the records so secured with the passenger train timings which appear so frequently in these columns. The exact estimation of load

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in the case of a train conveying miscellaneous goods is again no simple task. I mention these considerations as the bulk of readers will agree that it is the comparison of run with run, on an equal basis, that gives to a study of locomotive running the bulk of its interest. Another fact, which will doubtless surprise some of my younger friends, is that the aggregate of very nearly half-a-million miles that I have travelled during the last 13 years has not been exclusively for the purpose of securing data for these articles. Runs specially made for this purpose, indeed, probably amount to less than 5 per cent. of this total, although fortunately the business considerations that prompt the travel carry me over a wide area of country, and allow full latitude as to route. But this will explain why some lines do not always receive the attention I would like to give them, while lengthy journeys on express goods trains—the best of which always pursue the even tenor of their way in the very small hours—are not the easiest things to dovetail into one's weekly travelling programme!

And now for the restored two-hour services of the London and North Western Railway between London and Birmingham; I have not had as many journeys as I had hoped on these trains, but I have been happy enough to strike at least one startling *tour de force*. This I will commence with right away; the trip was made on the 2.30 p.m. express from New Street to Euston, and is the first of the runs figuring in the table, page 188. Full details of the gradients *en route* were given, with a profile, in the last issue, and there is therefore no need to recapitulate them. I believe I am correct in saying that this was the first occasion on which a "Claughton" had been used on one of these trains; the engine was working up to London from Wolverhampton in order to return on the heavy 6.55 p.m. down, and demonstrated very unmistakably that intermediate Coventry stops do not demand the lengthening of a 2-hour schedule to 125 minutes. With a clear road into Euston, indeed, despite an easy start to Coventry, and one equally easy from there to Rugby, we could have completed the whole journey, inclusive of two minutes standing, in 115 minutes! G. Leake, of Bushbury shed, was the driver, and he succeeded in demolishing two of my records by his notable work.

The allowance of 22 min. to Coventry demands no exceptional work; we were

Photo.] LONDON & NORTH WESTERN RAILWAY. [*F. E. Mackay.*

Down Birmingham express. 4-4-0 locomotive, No. 1138, "William Froude."

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doing 68 m.p.h. at Hampton, maintained 59 to Beechwood Tunnel, and touched 70½ before slowing down for the stop, which was very cautiously made. After re-starting, we proceeded with unusual moderation also to Rugby, not going above 57½ m.p.h., and reducing to no more than 34 m.p.h. through the latter station; up the subsequent ascent to Kilsby Tunnel we accelerated to 52 m.p.h.

But from Welton on to Sudbury we achieved the fastest time I have ever yet recorded over this length, covering the 67·2 miles in 58 min. 35 sec., at an average speed throughout of 68·8 m.p.h. My nearest previous approach to this time was one of 59 min. 25 sec., behind a 4-6-0 "Prince" with 215 tons on the 9.45 a.m. from Manchester to London, as recorded in my January article of 1915. We sustained 71½ m.p.h. before Weedon, passed Blisworth at 67 and the summit of the short rise to Roade at 62½; at Castlethorpe we were doing a level 77½, and from there fell gradually to 69 at Bletchley, 62½ at Leighton, 61 at Cheddington and 57 at Tring Summit; then our speed rose little by little to 78 m.p.h. at Boxmoor and 80½ at King's Langley—my first "eighty" anywhere south of Tring, and only the third I have noted on the London and North Western Railway south of Carnforth. Watford was passed at 72½ m.p.h., Bushey troughs at 66, Harrow at 71½ and Sudbury at 74, after which followed a tragic series of checks, evidently from that wretched 2.40 p.m. up Bletchley "slow," which is allowed to take the fast lines at Watford, although due in Euston only 5 min. in front of the "flier." Consequently we arrived in Euston over 5 min. late. With a clear road we should have economised 9 min. on schedule time between Rugby and Willesden! It will be noticed that the start-to-stop run of 87·8 miles between Coventry and mile-post 6½, leisurely start and Rugby slack included, was completed in well under "even time"—84¼ min., to be precise.

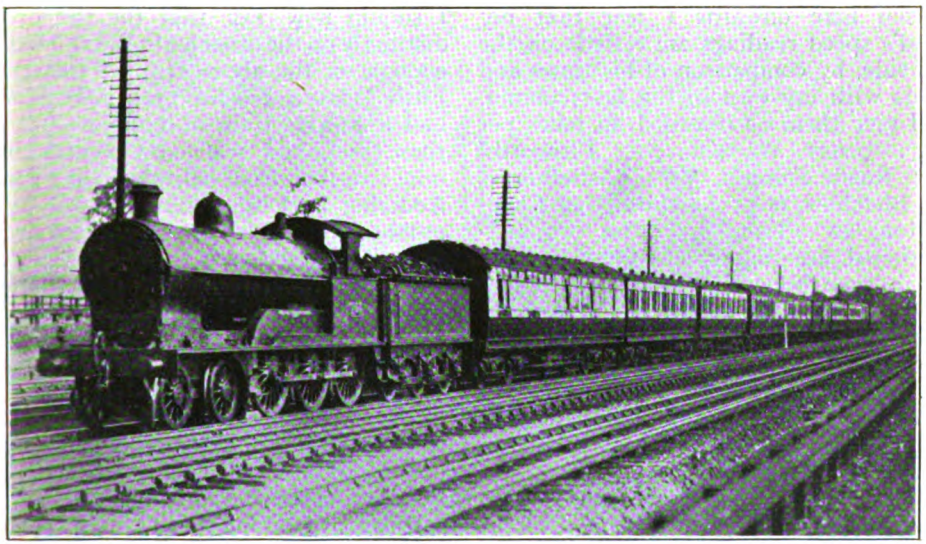

Photo.] LONDON & NORTH WESTERN RAILWAY. [*F. E. Mackay.*

Birmingham and Wolverhampton express. "Prince of Wales" class 4-6-0 locomotive No. 1324, "Falaba."

For the times on the second trip, which was made on one of the 200-ton 120-min. Coventry-stop trains, I am indebted to a correspondent. By dint of passing Stechford at 61½, Marston Green at 68 and Hampton at 72 m.p.h., not falling below 63 at Beechwood and touching 72 again thereafter, Coventry was made in within 10 sec. of the very sharp booking of 19 min. for the 18·9 miles—the smartest start-to-stop schedule, for its length, in force in the country to-day. New Street had been left 2 min. behind

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time; smart station working at Coventry (which might with advantage be studied by the staffs at Leamington and Banbury on the rival route) reduced the arrears to 1½ min., and an exceedingly long and severe permanent way check from Hillmorton box to the north end of Kilsby Tunnel provided the driver with still further incentive. The "Prince" made a much smarter start from Coventry to Rugby than the "Claughton," attaining 62 m.p.h. beyond Brandon, and the slack at Rugby was only to 50 m.p.h., but the long p.w.r. check then carried the "Prince" well behind by the time Welton was passed.

From here onwards I fear that my friend's speed readings are a little on the high side, by comparison of his times and speeds with my own in the first column, but I give them as recorded, in miles per hour: before Weedon, 70; Blisworth, 61½; Roade Summit, 56½; Castlethorpe, 74; Bletchley, 66½; Leighton, 63; Cheddington, 62; Tring, 57½ (the two last-mentioned are higher speeds than mine with a time between the stations longer by 8 sec.); King's Langley, 73½ (here again the speeds shown between Boxmoor and Watford range from 70 to 73½ m.p.h., when the *average* speed between these points works out at precisely 70); Bushey troughs, 64; and 72 between Harrow and Sudbury. An average of 1½ to 2 m.p.h. off these figures would probably put them right. The slack at Camden was very slight, and evidently worth less than ½-min.; but the Hillmorton p.w.r. occasioned a loss of fully 2½ min., leaving a net time of 94½ min. from Coventry to Euston, which is 4½ min. less than the booking. The "Claughton," with a 5 per cent. heavier load, would have completed the same journey of 94 miles in 91½ min., but for the final checks (on the basis of the "Prince's" times from Sudbury); with a start to Rugby proportionate to that of the latter, a time of 89½ min. might have been achieved. On such form the "Claughton" could take the same load with perfect ease from New Street to Euston in the even one-and-three-quarter hours. It will be noticed that the actual running time of the "Prince," delays included, was only 116 min. 5 sec., the net running time being precisely 113 min., or "even time," including slowing down for, and re-starting from Coventry, and the usual Rugby slack. Driver Willington is to be congratulated on so excellent a piece of work.

I had a run on the same express myself the other day, but from Bletchley onwards we had in front of us the Eastbourne train, which an "Experiment" was making dismal efforts to drag towards the sunny south; we passed it at Willesden ¾-hour late, and ourselves arrived 18¾ min. late. Incidentally, the remarks I made in the last issue as to the comparative punctuality of the two Birmingham routes no longer hold good, I fear; from recent experience I should now say that the the boot is distinctly on the other leg! We started well enough on the above trip; "George the Fifth" class 4-4-0 No. 1725, *John Bateson*, had a 22-axle train of 170 tons full (162 tons tare), and reached Coventry in 19 min. 10 sec. from Birmingham, passing Adderley Park in 3 min. 25 sec., at 55½ m.p.h.; Stechford, in 5 min. 20 sec., at 61½; Marston Green in 7¾ min., at 70½; Hampton in 10¾ min., at a well-sustained 75; Berkswell in 13 min. 35 sec.; and Tile Hill in 15 min. 25 sec. We did not fall below 67 m.p.h. at Beechwood Tunnel, but accelerated only to 70½ beyond, and ran very cautiously into Coventry; otherwise we might have stopped in a shade under 19 min., instead of 10 sec. over. For reasons I have already indicated, the subsequent running is not worth record.

Two other runs, in both cases timed by correspondents, on this exciting little Birmingham-Coventry "snippet," are well worth mention. A 4-6-0 "Prince," No. 859, *Charles Woolfe*, driven by Radford, with the same load of 170 tons, made a faster start and finish, passing Adderley Park in 3 min. 10 sec.; Stechford in 5 min. 5 sec., at 61 m.p.h.; Marston Green in 7 min. 28 sec., at 68 m.p.h.; Hampton in 10 min. 28 sec., at 73 m.p.h.; Berkswell in 13 min. 25 sec., and Tile Hill in 15 min. 15 sec.; minimum at the tunnel was 65 m.p.h. and maximum beyond 76 m.p.h. But the palm must go to 4-4-0 "George," No. 1777, *Widgeon*, driven by Mather, which actually reached Coventry in 17 min. 40 sec., passing Stechford at 67 m.p.h., attaining 81 m.p.h. near Hampton, not falling below 73½ at Beechwood Tunnel, and touching

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78½ again before slacking for the stop at Coventry. Stechford was passed in 4 min. 30 sec., but the remaining times are unfortunately missing from the log, except that at Tile Hill, which is barely in agreement with the speeds registered. I have reason to believe, however, that the latter are accurate.

By comparison, the two down journeys that I have tabulated are distinctly tame. *Pathfinder* had a heavy and packed train to handle on a Wolverhampton race day, and the running was, like the "curate's egg," good in parts and distinctly poor in others. A fair start was made to Willesden, where we reached 57 m.p.h., but we fell to 52 at Pinner; after doing 61 at Watford, the best work of the trip then followed to Tring, speed falling only to 57 m.p.h. at Langley, 55½ at Berkhamsted and 55 at the summit. Touching 72½ m.p.h. on the descent, we were through Bletchley practically on time, but the Wolverton p.w.r. slack appeared to take heart out of the driver, and we never fully recovered the loss. We topped Roade summit at 53 m.p.h., and Kilsby at 53½, with a maximum of 65 beyond Blisworth; 67 m.p.h. was the rate reached at Brandon, but the going up to Beechwood Tunnel was poor (minimum 50½ m.p.h.), and we did not get above 65 at Hampton. Net time for the journey was a shade under 119½ min., but I think the driver could without any difficulty have knocked off the excess of 80 sec. over gross time had he so chosen.

On the 11.30 a.m. down *Snipe* had a very easy task; the start was excellent, and the time out to Willesden the fastest I have recorded for many a long day; we touched 64 m.p.h. before Sudbury, only fell to 57 at Pinner, reached 64½ at Watford, dropped to 53½ at Tring, and then went under very easy steam (being before time) on to Bletchley, not exceeding 70 m.p.h. at any point. Indeed, this

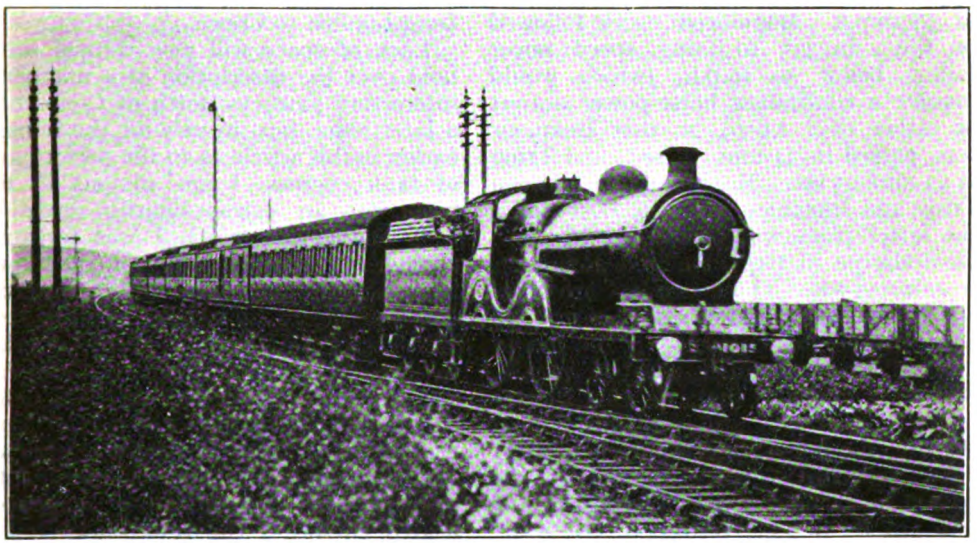

Photo.] GREAT CENTRAL RAILWAY. [*H. L. Salmon.*

Newcastle-Swansea express approaching Leicester. 4-4-0 engine, No. 1015.

but we fell to 52 at Pinner; after doing 61 at Watford, the best work of the trip then followed to Tring, speed falling only to 57 m.p.h. at Langley, 55½ at Berkhamsted and 55 at the summit. Touching 72½ m.p.h. on the descent, we were through Bletchley practically on time, but the Wolverton p.w.r. slack appeared to take heart out of the driver, and we never fully recovered the loss. We topped Roade summit at 53 m.p.h., and Kilsby at 53½, with a maximum of 65 beyond Blisworth; 67 m.p.h. was the rate reached at Brandon, but the going up to Beechwood Tunnel was poor (minimum 50½ m.p.h.), and we did not type of running continued to Rugby, after which we touched 70½ m.p.h. at Brandon, and should have made Coventry in 98 min. from town, but for a slight signal check. Re-starting, we accelerated uphill to 52½ m.p.h. at Beechwood Tunnel, and touched 70½ again at Hampton, gaining 40 sec. between Coventry and Birmingham. On this train also we could with perfect ease have completed the journey from London to Birmingham in 2 hours, with a 2-minute stop at Coventry; there seems little reason, indeed, why the Coventry stop should not become as standard a feature of the London and North Western Railway 2-hour timings as

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the Leamington stop on the Great Western Railway route.

One of the finest specimens of "Claughton" performance that I have seen for a long time—weight-pulling rather than high speed, this time—reaches me from a Rochester correspondent. The train concerned was 1.30 p.m. down "Scotsman," made up to no less than 438 tons tare load, and, packed as it was with passengers (the journey was made in the height of summer), weighing fully 470 to 475 tons gross; the engine was No. 30. Chalk Farm widening slack being then in force, it took 13 min. 20 sec. to get through Willesden, 20 min. 25 sec. to Harrow, and 27¼ min. to Watford, which was passed at 58 m.p.h. Magnificent work followed on the 1 in 335 to Tring, speed never falling below 50 m.p.h. (which would involve a continuous horse-power output of rather over 1,650), so that Boxmoor was passed in 34 min. 55 sec., and Tring in 43 min. 25 sec. Maximum rate between Tring and Bletchley was only 66 m.p.h.; the latter place was passed in 57¾ min., Castlethorpe in 65½ min. and Roade in 70 min. 55 sec. These two last are actually better times than on either of my two down Birmingham journeys; the lowest rate at Roade summit was 53 m.p.h., and even allowing that, on this shorter incline, speed was still probably falling slightly, the horse-power figure here must have exceeded 1,700. Blisworth was passed in 74 min. 5 sec., Weedon in 80¾ min., at 63 m.p.h., Welton in 86½ min., and a minimum of 53 m.p.h. at Kilsby, with a subsequent maximum of 67 at Hillmorton, brought the train into Rugby on time in 94 min. 50 sec., or about 93 min. net. Schedule is 95 min.

Re-starting with a slightly reduced load of 445 tons, No. 30 then passed Shilton, 8·8 miles, in 12 min. 5 sec., Nuneaton, 14·6 miles, in 17 min. 55 sec.; and Atherstone, 19·8 miles, in 22 min. 40 sec. Speed rose to 70 m.p.h. before and after Atherstone, but beyond Polesworth was badly reduced for the permanent colliery working caution now in force, so that the highest rate attained at Hademore troughs was only 58 m.p.h. Tamworth, 27·5 miles, was passed in 30 min. 35 sec.; and Lichfield, 33·7 miles, in 37 min. 40 sec.; with a minimum of 52 m.p.h. on Lichfield bank, Rugeley, 41·7 miles, was passed in 46 min. 5 sec., at 60 m.p.h.; Colwich, 44·6 miles, in 49 min. 5 sec.; and Stafford, 51 miles, after the usual slack at Trent Valley Junction, in 56¼ min. On the rising grades which follow, speed rose to 51 m.p.h., Norton Bridge, 56·3 miles, being breasted in 63¼ min.; Whitmore (summit), 65 miles, was passed in 73 min. 20 sec.; and a final maximum of 73 m.p.h. on Madeley bank brought the train into Crewe, 75·5 miles, in 85 min. precisely, a minute ahead of time. Net time I should put at 83 min., so that the driver had 5 min. to his credit between Euston and Crewe, despite this tremendous load; the running times were equivalent to a non-stop journey of 174 min. from London to Crewe.

Lack of space will now compel me to hold over the description of a number of interesting journeys north of Crewe until a later issue, but, in view of the remarks earlier in this article as to the performance of tank engines, I am anxious to find room for an extraordinarily creditable tank engine run which I was fortunate enough to time recently on the North Staffordshire line. The train concerned was the heavy 12.5 p.m. express from Manchester to London, always worked to Stoke by the North Staffordshire Company; on this occasion a slight defect had developed in the large 0–6–4 superheated tank engine usually employed, and the only substitute available at the moment was a small 0–6–2 non-superheated engine of the type illustrated on page 186. This little engine, No. 158, was faced with the haulage at express speed of a corridor train consisting of seven large 8-wheeled vehicles and two 12-wheeled dining cars, weighing 298 tons empty, and 310 tons full. My timing commences at Stockport, from which point to Macclesfield the grades are exclusively rising, very gently to Cheadle Hulme, where a severe slack is in force over the diverging junction, and then for 9¼ miles, first 1 in 192–240 to the half-way point at Adlington, and after that in more broken grades, as steep in parts as 1 in 166 and 1 in 154, to Macclesfield; the vertical rise from Cheadle Hulme to Macclesfield is about 170 ft. We passed Cheadle Hulme, 2·4 miles, in 5 min. 25 sec., at a reduced speed of 28 m.p.h.; accelerated to 39·1 m.p.h.

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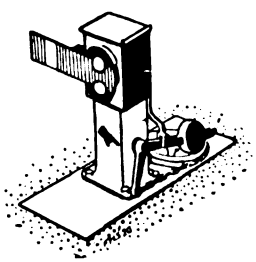
on the 1 in 192, which would involve an output of 865 h.p., to Poynton (5·3 miles, 10 min. 35 sec.), and to 40·2 on the subsequent 1 in 240 to Adlington (7·4 miles, 12 min. 55 sec.); Prestbury, 9·3 miles, was passed in 16¾ min., and Hibel Road, 11·7 miles, was reached in 21 min. exactly, allowed 18 min. Re-starting with the usual banking assistance in rear up to Macclesfield Moss Box—an incline which includes 1¼ miles at 1 in 102—we passed that box, 2·3 miles, in 6½ min., at 28 m.p.h.; the subsequent descent at 1 in 176 to North Rode viaduct brought the speed up to 49 m.p.h., and then we further accelerated to 53 m.p.h. at Congleton, down a short length of 1 in 264, and subsequently, on a perfectly level track, to 53½ m.p.h. at Harecastle. So the 5·8 miles from Moss Box to Congleton were run in 7 min. 40 sec., the 5·6 miles thence to Harecastle in 6 min. 35 sec., the 3·3 miles on to Longport in 3 min. 55 sec., and the last 2·9 miles into Stoke in 3 min. 55 sec.—total, 28 min. 35 sec. for the 19·9 miles from Macclesfield, or a loss of only 1½ min. on schedule. The handling of the engine on this run was a masterly performance—in all the circumstances yielding nothing in merit to the "Claughton" run just previously described—and Driver James Wilmer, for whose name I am indebted to the Locomotive Superintendent, Mr. J. A. Hookham, deserves warm congratulation for so noteworthy an achievement.

By way of contrast, I will conclude with a brief description of two runs behind the large 0–6–4 tank engines on the same train, No. 119 having a 45-axle train of 335 tons gross, and No. 118 one of 48 axles, weighing full 365 tons. Cheadle Hulme was passed in 5¼ min. and 4 min. 55 sec., in both cases at 30 m.p.h.; Poynton in 10 min. 30 and 15 sec.; Adlington in 13 min. 45 and 30 sec.; Prestbury in 16 min. 40 and 20 sec., and Macclesfield was reached in 20 min. 35 and 20 sec. Assistance in rear was provided on both runs to the Moss Box, which was passed in 5 min. 40 and 30 sec., at 33 and 31½ m.p.h.; speed at North Rode was 56½ and 61 m.p.h., at Harecastle, 56½ and 54 m.p.h.; and at Longport 60 by 119, whereas 118 had been slowed in the tunnel by a slight p.w.r. check. So the times were 6 min. 45 and 35 sec. from Moss Box to Congleton, 6 min. 15 and 10 sec. thence to Harecastle, 3½ min. and 4 min. 5 sec. through the tunnel to Longport (including the check on the second run) and 4 min. 35 and 30 sec., inclusive of a thick fog on the first trip and adverse signals on the second, from Longport into Stoke. Total times from Macclesfield to Stoke were therefore 26 min. 45 and 50 sec., or 26 and 25¾ min. net respectively. No. 118, with the heavier load, therefore did the best work, but in both cases the running was well inside schedule time. It is worthy of note, indeed, that the North Stafford portion of the journey of this express is now restored to its pre-war time, whereas the London and North Western portion has still to make up ten minutes of leeway. In justice it should, however, be added that the loss of the Birmingham portion (now run independently from Manchester to Stoke) has somewhat lightened the load over the N.S.R. section of the journey, whereas south of Stoke the train averages something distinctly in excess of its pre-war formation.



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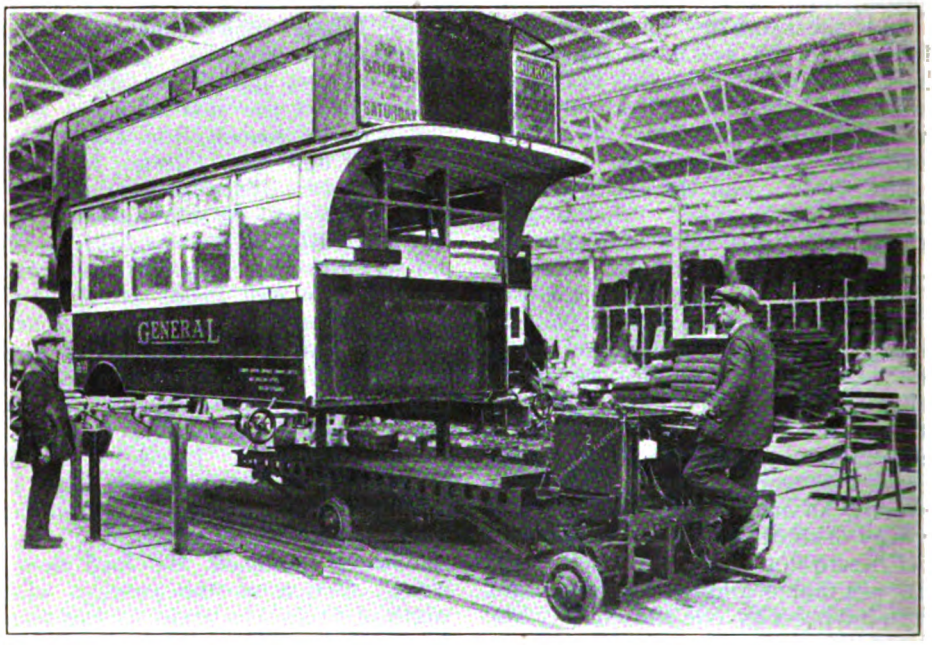
Chiswick Overhaul Depot, L.G.O.C.

ALTHOUGH it is little more than 15 years since the motor omnibus was definitely established in London street traffic, the London General Omnibus Company now operates about 3,000 vehicles, including B, K and S types, on routes which radiate as far as Guildford, Windsor, Maidenhead, Epping, etc., besides crossing and recrossing the Metropolitan area in all directions and in constant succession. With so large a fleet equipped specially for the purpose, every stage of the work is provided for, the best organisation becomes practicable, and methods which could not be adopted on a smaller scale can here be employed, with the result that, on an average, an omnibus is overhauled and repaired and turned out as good as new for another 12 months' service, within four days as compared with 16, the usual non-revenue-earning period hitherto. Ordinary repairs are still done



BODY LIFT AND ELECTRIC TRUCK.

even ordinary running repairs and maintenance cause a great deal of work at depôts, but the chief object of the new overhaul depôt at Chiswick, recently brought into use, is to systemise and expedite the annaul complete overhaul which every vehicle receives. Previously this work was done at the various larger depôts, but obviously none of these justified the complete installation of plant and equipment necessary to enable this to be done with the highest efficiency. By centralising all this work therefore at the new depôt, which is laid out and at the various garages, but for annual overhaul every vehicle now goes to Chiswick, and the older overhaul depôts have been closed down, though much of their plant has been utilised in equipping the new depôt.

The new depôt is on a site of about 31 acres, but this includes an "Underground" sports ground, and large mess and dining rooms, in addition to the works proper, the main building covering an area of some 300,000 sq. ft. A commencement was made in September, 1920, and by March, 1921, a certain amount of work

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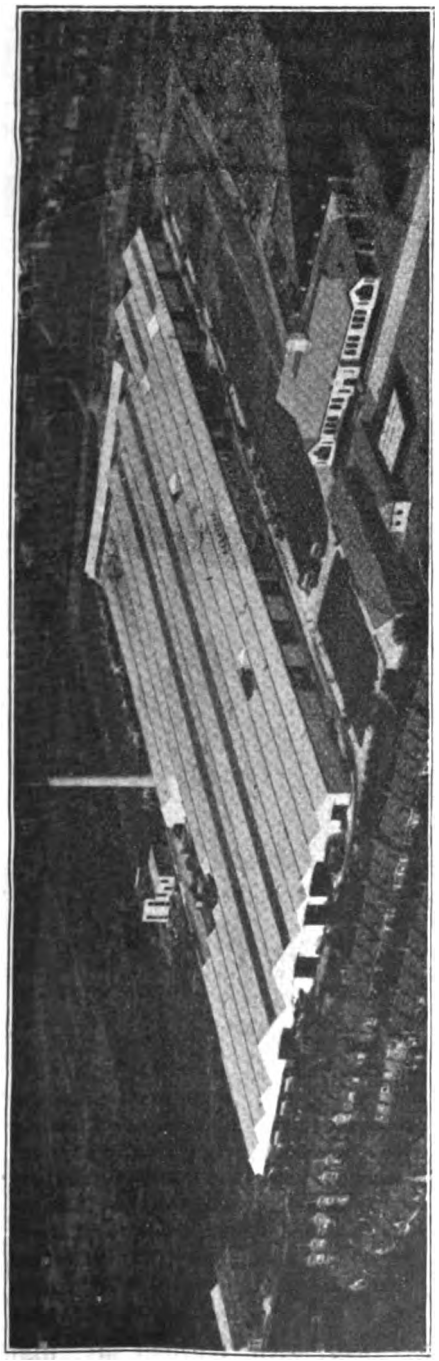
was being done in the coach-building section. On the engineering side work was begun in August last, and in September 50 vehicles were being turned out weekly. Now the output is about 100-120 per week. About 2,000 men are employed.



AERIAL VIEW OF LONDON GENERAL OMNIBUS COMPANY'S OVERHAUL WORKS AT CHISWICK.

Approached from Chiswick High Road the main avenue is flanked on one side by the office building and on the other by the large dining hall, mess room and canteen. Vehicles for overhaul arrive under their own power, and after stopping while the connecting bolts are removed are backed into the demounting shop. Here they are placed between multiple jacks which lift the body clear, the chassis is driven away to the chassis shop, and an electric trolley is backed in and the body is lowered on to it and taken away to the body shop all within a few minutes of arrival and occupying the demounting shop for about 2½ minutes only.

In the body shop the coachwork is stripped, replace parts obtained from the adjacent stores and woodworking and machine shops, and in due course the body is transferred, again by means of an electric trolley, to the paint shop. There it is transferred to the mounting and finishing shops, where cushions, aprons and boards are fitted, the electricians and others doing their parts of the work of finishing off, and equipped for the road.

In the chassis and engine section, on arrival the petrol tank is emptied and the chassis moved along as it is stripped stage by stage, the parts as they are detached being placed in cleaning boshes (if required) devoted to one item or section, inspected and tested and then passed down a line of workers at right angles to the stripping line. Conveyors are used to expedite this work, the principle being that while at one end of the shop the chassis is stripped to serve a number of lines of benches and machines, at the other end the parts leave individual lines ready for an erecting line. The latter is served by a slow-moving travelling platform (about 6 in. per minute) which carries chassis and workmen, the speed being so timed that the men can complete their work in turn as the various parts and fittings are attached and adjusted until at the end the chassis is completely equipped, the petrol tank filled, a starting device brought into use to start the engine, which is necessarily cold, and the chassis driven away to receive its body.

Many of the special cleaning and machining appliances are of great interest, but they cannot be set out here in detail. Suffice it to say that there is complete

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equipment at every stage, while numerous special sections, such as the research department and laboratory, the first-aid station, etc., are located as convenient. It is worthy of note that a great point is made of standardisation at every stage, No. 1 standard worn parts being machined to No. 2 standard and so on, and in re-assembling all parts are of the same standard, thus avoiding any confusion or bad fitting. A feature of the works area is the testing road, graded to meet requirements.

In connection with the official opening of the new works, a luncheon was held at the Hotel Victoria on Tuesday, January 31. A large gathering representative of the technical and general press was present, and among the officers of the Underground group who attended were Messrs. G. J. Shave, J. P. Thomas, A. L. Barber, S. J. Webb, J. B. MacKinnon, A. Rozier, C. Leese, O. W. J. Watson, S. Gage, G. Rushton, I. Fraser, J. H. Richardson and H. T. Carr. Mr. G. J. Shave occupied the chair, and expressed Lord Ashfield's regret at his inability to be present. He then gave an interesting account of the speeding-up of the repair side of the company's activities and of the important part that the Chiswick Works would play in future. Since the beginning of 1920, said Mr. Shave, the London General Omnibus Company had spent over £2,500,000 on providing new and more comfortable 'buses. Last year the total actual car mileage was in excess of 100,000,000 miles, while nearly 1,000,000,000 passengers were carried. The efficiency record of lost mileage through breakdowns was only one-third mile in every thousand. During the present year the Chiswick factory would enable the company to beat all those records. The new works had been built in a little more than a year and had cost about £500,000; but as it would enable the overhaul of the fleet to be conducted more efficiently and four times as quickly, the gain both to the company and the public would be worth the expenditure.

MATERIAL CONVEYOR.

Dealing further with Chiswick Works, Mr. Shave said that there they had something entirely new, as the work of repair was conducted on mass production lines. The development of Chiswick would inevitably lead to further standardisation and enhanced efficiency. In the past vehicles had been repaired at many

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different places, whereas they would now be repaired under one roof and under one supervision. In conclusion, Mr. Shave stated that, while mass production methods were common in America, he did not think that even Americans had done anything in connection with the repair of vehicles that was at all comparable with the mass production system now in vogue at Chiswick.

After luncheon the party were conveyed to the works at Chiswick, and were conducted in groups by Mr. G. J. Shave, Chief Engineer and Operating Manager; Mr. C. Leese, Engineer-in-Charge; Mr. O. W. J. Watson, Experimental and Research Engineer; Mr. S. Gage, Coach Factory Superintendent; and Mr. G. Rushton, Production Engineer, together with other officers.

MADRID-BARCELONA SLEEPING CAR EXPRESS:

MADRID, ZARAGOSSA & ALICANTE RAILWAY, SPAIN.

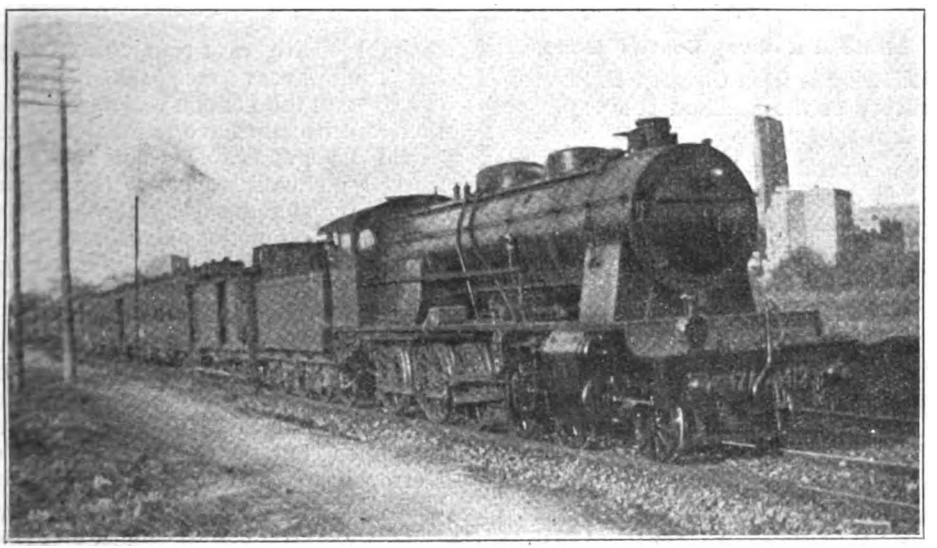

Photo.] [*R. V. Unwin.*

A NEW 4-8-0 passenger locomotive, No. 1412, built in 1921, is shown hauling this train. The load consists of 2 International Sleeping Car Company's sleepers, 1 dining car, 4 first class corridor bogies and 2 vans, about 260 tons empty. The journey of 685 km. is covered in 15 hours, including 13 stops, that at Zaragossa of 21 min. As the route is nearly all single-track and is severely graded throughout, this represents good work.

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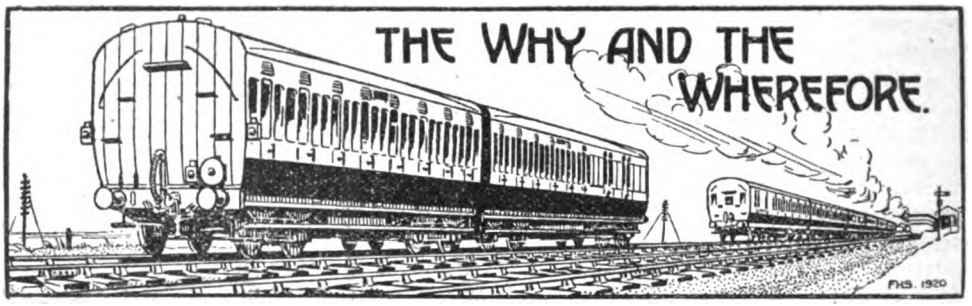

RAILWAY MAGAZINE *readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to locomotive sheds and to the dimensions of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. No reader should forward more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history and the like, readers should consult the pages of the "Railway Year Book." The twenty-fourth Annual Edition of this standard railway reference work is on sale, 5s. net, or by post, 5s. 9d. A new edition, to be published in April, 1922, is in preparation.*

Midland Railway Coat of Arms.

Following is from Clement E. Stretton's "History of the Midland Railway," published in 1901 :—

The fearful and wonderful creature perched on the top of the Midland Railway Company's coat of arms, painted on the passenger carriages and what not, is known as a wyvern, a sort of winged serpent, which, like the dragon, griffon, unicorn, etc., never existed outside the Heralds' College. The buck or deer within the park palings represents the town or "by" of the deer—Derby; on the right hand the castle and ships are the arms of the city of Bristol; and on the left are those of Birmingham. The arms of Lincoln are depicted under the deer with Leeds on the right and Leicester on the left. On the seal of the company Nottingham is represented instead of Bristol. The dolphin is on the left, the salamander on the right, and the wyvern on the top of the shield. At the time of the Saxon Heptarchy Leicester was the capital of Mercia, and the wyvern was the crest of the Mercian kings. The wyvern is a quartering of the town arms of Leicester, and was adopted as the crest of the Leicester and Swannington Line, out of which sprang the present Midland Railway. Hence it forms an important part and parcel of the Midland Company's coat of arms. [Reply to E. B.]

Automatic Signalling.

With automatic apparatus signals can be placed as close together as deemed desirable—with over-running or "overlap" allowances, etc., taken into account—and the London underground lines therefore usually have more signals than would be practicable were the signals worked manually. This is the explanation of the close headway at which trains are run. At junctions signalmen are employed, but they have illuminated track diagrams or indicators to show the movements of trains, and they do not exchange block signals, as there may be a dozen trains between them and the next box, there being none at intermediate stations. The City and South London still uses signalmen, but on the Metropolitan and Metropolitan District Railways the only boxes in use are those at junctions, or where crossovers and connections exist. Most of the surface electric railways are signalled as usual, and steam trains can and do use the same lines.

[Reply to "SILURIAN."]

"Chairman" Class, 0-4-0 Tank Engines, Great Eastern Railway,

Mr. G. M. Rickards sends further information as follows :—The *Chairman* is a saddle tank, with 12 in. by 18 in. cylinders (outside), and 3-ft. wheels. She came in 1872 from Manning, Wardle & Co. The name has long since been obliterated from the sides of the tank, and she is now known as "A, Works Only." The first of the "209" class came in 1874 from Neilson's, and has 12 in. by 20 in. cylinders, 3 ft. 7 in. wheels. No. 210 came the following year, and was broken up in 1914. Nos. 0228 and 229 came in 1876 from Neilsons'.

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No. 229 was sold in 1917 to Mr. Finch, Chepstow. Nos. 226 and 227 were built at Stratford in 1897, and were broken up in 1911 and 1912 respectively. Nos. 230 and 231 were built at Stratford in 1903. No. 230 is now yard shunter in the carriage shops, and No. 231 has been working at Hythe, as one of your readers has noticed. Nos. 230 and 0228 are fitted with Westinghouse and vacuum brake apparatus, and steam heating for testing the new and repaired carriages, but has steam brake only on itself.

[Further reply to H. H. BELL.]

The London and North Western Railway and Birmingham.

Congestion of the route concerned, as well as the longer distance, in themselves furnish strong reasons as to why trains for the north should not travel from London *via* Birmingham. Neither can we see how such diversion would render possible the cancellation of any of the 2-hour London–Birmingham expresses, seeing that the majority of the North expresses are exceedingly heavy trains, and in normal times carry a full load from Euston to north of Crewe; it would be impossible to work such trains on the 2-hour schedule between Euston and New Street, let alone if additional accommodation were provided for Birmingham passengers. An ample service of express trains from Birmingham to Crewe connects with all the leading north-bound trains. Excursion trains in the summer occasionally travel through from Euston *via* Stechford, Aston, Bescot and Bushbury to Stafford, in order to relieve the main line.

[Reply to H. G. H.]

The Kearney System.

Your long letter in support of the claims of the Kearney system is welcomed, but it may be pointed out that our reply was not intended so much by way of disparagement, as to epitomise the issue as it appeared to us. However, Mr. Chalmers Kearney, who has also challenged the terms of our reply, points out that the placing of stations near the surface is a very big advantage in itself, that he uses gravity to enable very high intermediate speeds to be attained, and that the concluding ascent is designed to avoid the use of brakes for stopping, and he would be the last to suggest that he is attempting to get more power from gravity than is applied. All he claims in this respect is that instead of wasting power by "braking," he utilises the "velocity head" obtained on the down grade to carry the train up the incline to a stop, thus avoiding the need for powerful brakes.

[Further reply to C. F. KLAPPER.]

The Meaning of "Tractive Effort."

"Tractive Effort" or "Tractive Force" is a figure calculated, in the way shown in the January issue, from the cylinder dimensions, driving wheel diameter, and working steam pressure of a locomotive. It represents the maximum possible force which can be developed at the periphery of the driving wheels for the purpose of moving the engine and its train, and assumes an adequate supply of steam from the boiler for this purpose. The relative power, based on tractive effort, of 3 and 4-cylinder engines respectively, depends obviously upon the diameter and stroke of the cylinders; if diameter and stroke were the same, the tractive force would be as 3 is to 4.

[Reply to G. and S. W. R., and S. E. SMITH.]

The "Best" Locomotives and Railways.

Obviously, as we have many times explained, it is impossible to describe any class of locomotive on any railway as the "best," seeing that there is no common basis of comparison. Certainly Great Western engines do magnificent work, and permanent-way, rolling-stock, etc., of that line are on a very high level. But other lines can claim corresponding honours, for it is necessary to take into account traffic characteristics and demands, engineering restrictions and difficulties, locomotive and rolling-stock policy, etc., and it does not follow that because one railway leads in certain respects that others would not, and could not, do as well were their circumstances and requirements the same.

[Reply to W. D. PORTER.]

The Severn Tunnel.

Important works are at present in progress in connection with the ventilation of the tunnel, and in order that the engineering staff may have exclusive possession of the lines for a certain period in each week, the Sunday services are diverted temporarily, those between London

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and South Wales travelling *via* Gloucester, and those between Bristol and South Wales *via* Filton, Westerleigh, Yate and the Midland Railway to Berkeley Road, and on by the Severn and Wye Joint (Great Western and Midland) over the Severn Bridge to Lydney, where the Gloucester line is joined. These deviations account for the heavy temporary increases in the timings of certain trains to which you refer.

[Reply to IRVING MATHER.]

Through Coaches, Cardiff-Newcastle.

We know of no regular through running having taken place at any time between these points other than that of the Great Western–Great Central Swansea-Newcastle (pre-war Barry–Newcastle) express, which travels *via* Cardiff, Cheltenham, Banbury, Leicester and Sheffield to York, and thence *via* North Eastern Railway. We think the coach you saw in 1917 at Crewe must have been labelled "Crewe–Newcastle," and not "Cardiff–Newcastle," as that was the only daily service in operation between Newcastle-on-Tyne and Crewe at the time you mention. The last-mentioned is now extended again to Swansea, *via* Shrewsbury and the Central Wales Line, as before the war.

[Reply to "BOLTONIAN."]

Upper Quadrant Signals, North Eastern Railway.

We are familiar with several locations on this railway in which ordinary signals have been arranged to rise, when in the "off" position, into the upper quadrant, instead of falling into the lower. These are mostly in places where the arm has not sufficient clearance from passing trains to be allowed to fall in the usual way, and we do not doubt that the signal to which you refer is one of these cases. Such signals are, of course, quite distinct from recent three-position and other modern types of signal, which invariably work in the upper quadrant.

[Reply to G. W. SPINK.]

North London Locomotives on the Great Northern Railway.

From constant use of the High Barnet branch we do not agree with your strictures on the work of the North London engines; in fact, load for load, we should be inclined to rate their average performance equally with that of the Great Northern Railway 4-4-2 and 0-6-2 tanks in pre-superheat days. Since the introduction of the superheated 0-6-2 engines, however, we agree that the continued use of the existing North London 4-4-0 type, especially on the heavy 13-coach trains of new stock, does constitute a difficulty in any prospective acceleration of the service.

[Reply to "NORTHERNITE."]

The Fastest Train in the World.

The 11 a.m. from Paddington to Bath has the fastest start-to-stop schedule, on the basis of throughout *average* speed, at present operating in any part of the world. But there are many trains which customarily attain higher *maximum* speeds than those attained on this run, which is made over a route unique in its absence of appreciable up-grades over so long a distance. What do you mean by a "100-mile record?" Numbers of considerably longer non-stop journeys are performed daily, on both the Great Western Railway and other lines.

[Reply to T. C. BEXLEY.]

Tractive Force of Locomotives.

Correction of the printer's error in the formula given in the December issue was made in the January number. We are obliged for the information that Canadian practice favours the use of a percentage of 85 per cent. of the working steam pressure in this formula, in place of the usual British figure of 80 per cent.; this is a matter in which opinions differ considerably. The formula in regard to compound locomotives has been given previously, and cannot be repeated.

[Reply to HUGH O. COLE and "MANCUNIAN."]

Midland Railway (London, Tilbury and Southend Section) Rolling-Stock.

The Derby-built bogie sets used for Southend express trains weigh 330 tons empty (13 coaches). As they are always very well loaded, usually conveying about 1,000 passengers, these are probably the heaviest trains of their kind on such services, especially when worked by 4-4-2 tank engines, and over a route which is far from easy. Main line express trains, however, frequently exceed this weight, which is by no means exceptional, except under the particular circumstances.

[Reply to V. H. JERMYN.]

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Stop Signals.

Where two or more stop arms are carried on one post the uppermost usually relates to the left-hand route, and so on in order towards the right. There are now few junctions where this arrangement still applies, and bracket arms are preferably adopted as being clearer; but where space is limited and often at termini this disposition is followed. Necessarily, drivers and others understand the signals, though there may be no special lettering or marking. Where the lower arms are smaller they are usually for shunting purposes.

[Reply to "PEACOCK."]

London Railways.

The Metropolitan and the Metropolitan District Railways are independent companies, quite distinct, except that they are associated for certain traffic facilities. The Inner Circle service is operated by trains of both companies, in proportion to the mileage supplied by each. They have certain joint sections, and in places they exercise running powers. The latter is generally abbreviated to "District," but its correct name is Metropolitan District. See RAILWAY YEAR BOOK for further information.

[Reply to "PEACOCK."]

Through Coach Workings, Midland Railway.

By the day service from Newcastle to Bristol at 8.0 a.m. (10.10 a.m. *ex* York), and from Bristol to Newcastle at 9.45 a.m. From Glasgow to Nottingham at 9.20 a.m., going forward from Leeds at 2.43 p.m. *via* Sheffield, in advance of the London portion as far as Rotherham; from Nottingham to Glasgow at 11.20 a.m., joining the 9.50 a.m. from London at Leeds.

[Reply to "BOLTONIAN."]

Great Western Railway Locomotives.

We are informed by Mr. C. B. Collett, Chief Mechanical Engineer, that Mr. Churchward originally intended to include in his standard series of outside cylinder locomotives a 4-6-0 with 5 ft. 8 in. coupled wheels, and for standardisation purposes the cylinders in other outside cylinder designs were set 2½ in. above the centre line of the axle to give sufficient clearance for the cylinders above the bogie in this particular design.

[Reply to C. V. ELLIS.]

Railway Distances.

Kettering–Nottingham, Midland Railway, 51 miles 38 chains; Southampton West–Brockenhurst, and from there to Bournemouth Central, London and South Western Railway, 13 miles 42 chains and 15 miles 13 chains respectively; Crewe–Chester, London and North Western Railway, 21 miles 9 chains. We have not by us the other distance for which you ask.

[Reply to A. G. BROOKS.]

Triangular Stations.

Mr. G. J. Marks specifies Earlestown Junction, London and North Western Railway, as a further example. Two platforms apply to the Liverpool-Manchester route, two to the Manchester-Warrington line, and two to the Warrington-Liverpool routes. There are platforms for each section.

[Further reply to A. RANSON-COWLISHAW.]

Wireless Telegraphy to and from Trains.

Experiments and trials have been, and are being made in this direction, not only in Germany and the United States, but also here. So far we have no information as to conspicuous success. Particulars appear in technical journals from time to time, and when there is anything special to record the matter will receive attention in the RAILWAY MAGAZINE.

[Reply to R. N. MICKLEWOOD.]

Locomotives of Isle of Wight Central Railway.

Boilers seen by you outside the Newport shops are doubtless for ordinary boiler renewal purposes. No engines were sent from this railway on war service. Illustrations have appeared in the RAILWAY MAGAZINE from time to time of the locomotives of the Isle of Wight railways.

[Reply to "BONCHURCH."]

Branch at High Dyke, Great Northern Main Line.

This branch, which leaves the main line at High Dyke Box, between Stoke Summit Tunnel and Great Ponton, on the down side, has been constructed to give direct access between the main line and the ore-mining district of Waltham-on-the-Wolds; it is used for mineral traffic only.

[Reply to "X. Y. Z."]

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Widely Separated Stations:

On the Australian Trans-Continental Railway some of the stations are 30 or 40 miles apart. It has been stated that in the Sudan there were two stations no less than 102 miles apart, but this is probably not the case now, and in any event there were almost certainly a few halts or calling places between.

[Reply to T. W. LINSELL.]

Great Western Railway 4-6-0 Engines in Cornwall.

We have not by us the exact date at which the 4-6-0 engines commenced to work west of Saltash bridge, but it is some years ago now, and followed the completion of certain works of underline bridge strengthening.

[Reply to J. D. THOMSON.]

Tenders, Caledonian Railway.

McIntosh bogie tenders used for 4-6-0 locomotives carried 5,000 gallons of water and 5 tons of coal, weight being 55 tons. Mr. Pickersgill's six-wheeled tenders as used for the large 4-6-0 engines carry 5½ tons of coal and 4,500 gallons of water, weight being 48 tons.

[Reply to J. T. RUTHERFORD.]

Rebuilt and Superheated 4-4-0 Engines, South Eastern and Chatham Railway.

See detailed article in the January issue of our contemporary *The Locomotive*, which contains a complete summary of the converted engines, with their numbers and dimensions.

[Reply to "S.E. & C.R." and others.]

Corridor Carriages, South-Eastern and Chatham Railway.

First and second class corridor carriages are now used in the Continental trains in order to give access to the Pullman cars for the supply of refreshments, etc. See October, 1921, RAILWAY MAGAZINE.

[Reply to J. C. DAVIS.]

Vestibuled Corridor Stock.

The first complete train was that used for the 2 p.m. from Euston, for many years known as "The Corridor" express. The Great Western Railway and other lines had, however, already connected several vehicles.

[Reply to J. T. RUTHERFORD.]

Narrow Gauge Railways.

Most of the light and narrow-gauge railways will retain their independence under grouping, as they are expressly excepted, though no doubt some of them will eventually come under the wings of their larger neighbours.

[Reply to "RAILWAYMAN."]

Rushey Platt Station, Midland and South Western Junction Railway.

This station was closed for passenger traffic in September, 1905, but through special trains are run to and from the Great Western Railway via Rushey Platt, which is still a crossing place for trains.

[Reply to A. H. T.]

Track Lay-out, South Eastern and Chatham Railway.

Mr. J. F. Gairns's article, "Traffic Aspects of Track Lay-out," in the September, 1920, RAILWAY MAGAZINE, described the track arrangement in detail between Charing Cross and New Cross.

[Reply to H. A. POPER.]

Great Northern Railway-London and North Western Railway Locomotive Trials.

No results were made public of these trials, but, so far as we are aware, the Great Northern Railway "Atlantic" took trains of average loading up Camden bank without assistance.

[Reply to S. E. SMITH.]

Great Western Railway Locomotive No. 4140.

Originally No. 3394, *Adelaide*, becoming No. 4140 in December, 1912, the name plates were removed when No. 4034 *Queen Adelaide* was placed in service to avoid possible confusion.

[Reply to R. HASEMAN.]

The Busiest Station.

Your query as to the busiest 2-track station on a steam-operated railway covers so vast a field of enquiry that we must leave you to search it out for yourself within the pages of *Bradshaw*, or elsewhere.

[Reply to "MANCUNIAN."]

Midland Railway Locomotives.

Before the present colour was adopted in Mr. Johnson's early days, Midland locomotives were painted green. See Mr. Ahrons' articles, Midland Railway section.

[Reply to W. B.]

Longest Station Platforms.

Later information is as given in previous reply, that the up main platform at York

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is 1,692 ft. in length. The 1922 edition of the RAILWAY YEAR BOOK will include this correction.

[Reply to J. S. FROST.]

0-6-2 Tank Engines, London and North Western Railway.

The latest census of these engines gives the total as 373; they are used all over the system. We know nothing of the other type you mention.

[Reply to "SALONIAN."]

Double-heading on South Eastern and Chatham Railway.

Double-heading of up afternoon Continental express doubtless arises from considerations of weight. Your second query is not clear.

[Reply to "LESOWEN."]

Summit Levels, North Eastern Railway.

Weatherhill, 1,444 ft.; between Barras and Spital, 1,378 ft.; and Stainmoor, 1,369 ft. The 1922 RAILWAY YEAR BOOK will make this clear.

[Reply to CHALONER WHIN.]

0-6-2 Tank Engines "1000" class, Great Eastern Railway.

No. 1001 is superheated, but No. 1000 and Nos. 1002–1010 are not, though all have snifting-valves.

[Reply to G. H.]

Coach Colours.

Passenger carriages in use on the Leek and Manifold Light Railway are painted crimson lake.

[Reply to A. W. P.-M.]

Skipton and Grassington.

Between these two Midland stations the line was opened for passenger traffic July 30, 1902.

[Reply to J. S. F.]

Largest Railway Station in the World.

Grand Central Terminal, New York, U.S.A., which has 43 platforms on two levels.

[Reply to T. W. LINSELL.]

Great Eastern Railway Locomotives.

No 4-4-2 engines have at any time been built for this railway.

[Reply to C. K. DOUGLAS.]

"A" Platform, Paddington.

This platform, generally used for excursion trains, is 930 ft. in length.

[Reply to F. CAMPBELL.]

Photo.] **LONDON AND SOUTH WESTERN RAILWAY.** [*J. T. Burge, Jun.*

Waterloo-Bournemouth Express emerging from Tunnel east of Southampton West Station.

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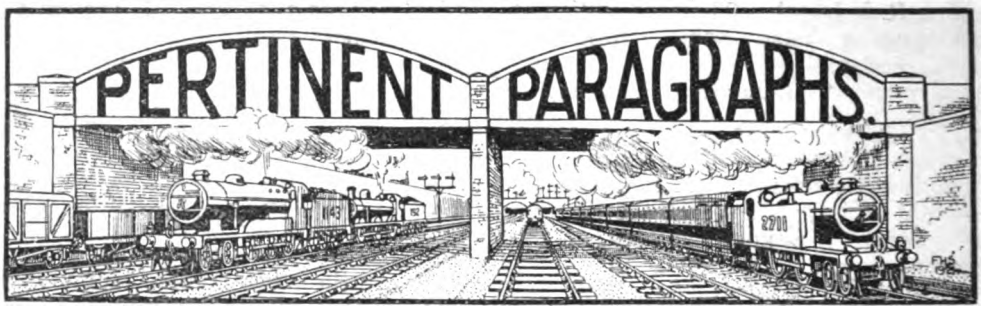

CHANGE OF ADDRESS AND TELEPHONE NUMBER.

The Editorial, Advertisement and Publishing Offices of The Railway Publishing Company Limited, proprietors of "The Railway Magazine" and "The Railway Year Book" have been removed from 30, Fetter Lane, London, E.C.4, to larger premises at Sanctuary House, 33, Tothill Street, Westminster, S.W.1, where in future all communications should be addressed. Telephone Number is now Victoria 8836 (3 lines).

Scottish Railways and the "Spread-over."

READERS will be generally familiar with the proceedings before the National Wages Board to hear the application by the Scottish railway companies to authorise modifications of the wages and certain conditions of service of Scottish railway employees. Mr. D. A. Matheson, General Manager, Caledonian Railway, conducted the case for the five Scottish companies, and Mr. C. T. Cramp, Industrial General Secretary, for the National Union of Railwaymen. A wealth of statistical information was presented, showing the extreme nature of the employment conditions on many of the more remote sections of Scottish railways, with infrequent trains and little to be done in connection with them, causing the cost of staff to be unduly high and entirely out of proportion either to traffic value or volume. Striking comparisons were also shown between railway wages and comparable wages for other employment in many districts. The standardisation of wages and the eight-hour day had, in fact, increased expenses, compared with 1913, by very large percentages, in some instances of over 300 and even 400 per cent, though revenue had rarely increased by more than 100 per cent., if as much. Special stress was laid upon the large proportion of "idle" time, most of it unavoidably incurred owing to the spasmodic nature of railway work on the lighter traffic sections. The increase was due not only to higher wages but to the larger numbers of men necessarily employed to do the same amount of work. Night working, enginemen and guards' turns of duty, the working of signalmen and other matters received close attention.

The Award.

WHILST falling in general far short of the requirements of the Scottish companies, the majority decision refused outright only one of the claims, viz., that the special payment for night duty shall be discontinued. The impression gained from hearing the evidence on this point was that while the railway officers were right in their contention that night work was not more dangerous or arduous than day work, yet that it subjected the men to greater strain on their faculties of observation, disturbed their normal habits and caused them inconvenience and expense in their domestic arrangements.

As to the award of June, 1920, the majority of the Board did not agree to its immediate withdrawal, but provided for its gradual removal in connection with the sliding scale by taking off 2s. instead of 1s. on any subsequent fall in the cost of living until that is effected, with the proviso that in no case shall wages be reduced below the standard rate. This disposes of the view that this advance was part of the "standardised" wages, but it by no means satisfied the Scottish companies, whose two representatives on the Board pointed out that the position of those companies necessitates an immediate reduction in wages and that in any case relief under this finding cannot be obtained until April 1 next.

With regard to junior employees, the decision of the majority is that 20 shall be the adult age, and it provides for graduated scales of pay for youths of 15 to 20, whether new entrants or existing employees. The extension to existing employees was a point on which the Scottish companies laid some stress.

In their request for a modification of the universal eight-hour day, the Scottish com-

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panies asked for 10 and 12-hour periods of duty, to be arranged where traffic was intermittent. What the award gives is a split turn arrangement, *i.e.*, a spread-over of 10 or 12 hours, with a 2 or 4 hour break during those periods. This means, as Mr. Cramp pointed out in his answer to Sir Henry Thornton, that for every moment a man is at the disposal of the company, he must be paid. How to fit in the necessary "breaks" with the requirements of the service on lines where traffic is only intermittent is a far more difficult problem.

Mr. J. Calder, General Manager, North British Railway, and Mr. D. Cooper, General Manager, Glasgow and South Western Railway state, in a minority report, that the findings of the majority, in their views, fall far short of meeting the necessities of the Scottish railway companies and would only in small measure relieve them of the enormous burden placed upon them by the universal application of the 8-hours' day—a burden which neither the Scottish railway companies nor the industries of Scotland can bear.

Design and Express Locomotive Performance.

ON January 6 in Manchester, and on January 26 in London, Mr. Cecil J. Allen, Associate, read a paper before the Institution of Locomotive Engineers entitled "Notes on the Influence of Design on Express Locomotive Performance." Much of the ground covered will be familiar to readers of "British Locomotive Practice and Performance"; and may be briefly summarised as setting forth examples of the wide variations in British locomotive practice as to comparative dimensions, ratios, etc., and the equally diverse results shown in speed and hauling capabilities. Also the differing practices of drivers which further diversify the results given as between engines of the same designs. Mr. Allen quoted some of the locomotive trials and tests of which records are available, and discussed points such as the dimensions of exhaust ports, the influence upon free-running of piston valves, and the value of superheating. In conclusion he suggested that a continuous and exhaustive inquiry into the running characteristics of different locomotive classes conducted in regard to construction, operating and maintenance costs, and taking into account the varying methods of drivers, "should prove a mine of information to those engaged in locomotive design."

Are Tube Railways Tunnels?

WRITING in the pages of the *Sheffield Daily Telegraph* recently, Mr. S. T. James pointed out some of the "clear-cut individualities" which distinguish each of the great railways. For instance, the typical signals and posts of various lines, engine and rolling-stock liveries, station architecture, etc., and, more particularly, aspects such as "the suggestion of spaciousness" so often noticeable in regard to the Great Western Railway; the "old-world urbanity" of the London and North Western, "in harmony with the massive gates of Euston"; the "perky aggressiveness" of the Great Central; the "autocratic" North Eastern, and so on.

But the most important claim, all the rest being familiar ground to readers of the RAILWAY MAGAZINE, is one as to which a Sheffield reader invites an expression of opinion—that the "Piccadilly" tube is the longest railway tunnel in the United Kingdom, about eight miles from Baron's Court to Finsbury Park. On this basis the Central London, "Bakerloo," "Hampstead" and "City and South London" "tubes" are close "followers up," all longer than the Severn Tunnel between their surface points, if any.

Possibly these may satisfy strict definition of a "tunnel," but it is usually understood that a tunnel is built in order to overcome natural difficulties and the circumstances of particular geographical locations, whereas a "tube" railway is intentionally built at a low level, and with surface communication at frequent intervals, though both stations and lines are entirely underground. Correctly, therefore, only the sections between stations are "tunnels," the stations having surface access and therefore not satisfying any practical definition of "tunnel." In fact, these lines are constructed to meet "artificial" conditions, and it does not seem that they can in any degree be considered in the same category as our longest tunnels, ingenious though the suggestion may appear.

Railway Discrepancies.

IN replying to a query recently it was suggested that many of the more or less contradictory statements which have been published, more especially those concerning the opening of various sections of line, are explained by the differing points of view, though not infrequently a genuine mistake once made becomes a perpetual source of confusion, as it is liable to be quoted and used in competition with the correct information. Mr. W. B. Thompson, of Brampton, Cumberland, comments upon this tendency, instancing examples where, even in standard works of reference, and in reference to many aspects of railroading there is by no means general agreement. His letter may be quoted nearly in full as follows:—

I note that on page 255 of the October number of the RAILWAY MAGAZINE you refer to the gradient of the rise from Victoria

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Station to Grosvenor Road Bridge as 1 in 61. This agrees with the figure given by the *Railway Engineer* for February, 1909; but for the Brighton Company's line into Victoria the *Railway Gazette* recently gave the gradient as 1 in 57, while every other authority with which I am acquainted, from the *Engineer* of 1874 to the RAILWAY MAGAZINE of September, 1915, gives 1 in 64. It is difficult on looking at the lines to see any difference in the slope of those belonging to the different companies, and it would be interesting to know which, if any, of the various figures stated is correct.

Our railway literature is full of similar discrepancies. For instance:—

(1) Dempsey's "Practical Railway Engineer" (1855), on one page gives the length of the Box Tunnel as 3,123 yards, on another page as 3,227 yards; Williams' "Our Iron Roads" (1888), says 3,203 yards; Protheroe says 3,212 yards, and so on..

(2) On February 1, 1884, *Engineering* published a profile of the London and North Western Railway from Euston to Carlisle; on May 1, 1914, the *Railway Gazette* published a profile of the same line giving differing gradients at nearly every point. Presumably the line had been re-surveyed between 1884 and 1914; when the next generation of engineers survey it again perhaps they will obtain still other results!

(3) On page 243 of Tomlinson's "History of the North Eastern Railway" (1914), special attention is called to the fact that the summit of the North Eastern line at Whiteleahead is the highest point reached by a railway in England, and the elevation is stated to be 1,445 ft. The *Locomotive Magazine* for December 14, 1918, referring to the same point gave the elevation as 1,474 ft.

(4) On February 23, 1920, *Engineering* published a profile of the railway between Newcastle and Carlisle showing the elevation of the summit as 404 ft. Bradshaw's "Railway Companion" for 1842 gives the elevation 546½ ft.; the local ordnance map says about 458 ft. In the same article in *Engineering* the steam pressure of the new North Eastern Railway mineral engines is given as 180 lb.; on page 279 of your current—October—number the pressure is stated to be 200 lb.

(5) The North British Locomotive Company recently issued a souvenir volume illustrating various engines of historical interest built by the constituent firms of Neilson, Dübs, and Sharpe Stewart. In the account of Caledonian engine 123 built by Neilson's in 1886 details are given of its fine work for the East Coast companies between *Newcastle and Edinburgh*! in the race to the north.

An English locomotive builder wrote to me not long ago with reference to an interesting class of engine which his firm was building. He gave a number of particulars in his letter, and to make matters quite clear, enclosed a dimensioned drawing. On looking at the drawing I at once noticed that the cylinder dimensions shown did not agree with those stated in the letter.

In short, I have here books and papers relating to railways for the last 100 years, and the number of inconsistent statements in them is so great that I would hesitate to say with confidence that any assertion whatever is really accurate.

Colour Light Signals.

A COMMITTEE was appointed in July, 1921, to investigate, on behalf of the Ministry of Transport, the potentialities of colour light signals for wide adoption in place of semaphores, both by day and night. It has recently reported, bringing out several interesting points as shown by the following summary:—

(*a*) Colour light signals compare, at present, favourably in initial and maintenance costs with manual and power operated semaphores, and future development will doubtless allow this type of signal to show to further advantage in this direction.

(*b*) They make for other economies as enumerated in the report.

(*c*) The same indication is given to drivers by night and by day, and always of a definite character.

(*d*) This type of signal is less prone than the semaphore to show a doubtful or wrong signal indication due to outside interference.

(*e*) They can be easily adapted to two or three positions automatic, semi-automatic, and manual signalling.

(*f*) They are more easily controlled and slotted than manual signals.

It is considered that there should be only three types of signals:—(1) Running signals requiring long range; (2) running signals requiring short range; and (3) shunting signals. The mechanisms and cases in (1) and (2) would be identical but the candle-power would be different. The detection of points by electrical means will be necessary—this can be done by passing the current through electrical switches at the points—and it is considered desirable that lenses alone and not lenses with reflectors be provided. It is of interest to note that the committee does not consider that the use of extension hoods is required.

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A 201-Car Train.

In view of the "Pertinent Paragraph" under this heading in the November RAILWAY MAGAZINE, Mr. W. T. Hoecker, of Galveston, Texas, U.S.A., writes: "While this was a very creditable performance, permit me to draw your attention to a better one which was accomplished on the Erie Railroad in the same year. The extract below is from the Baldwin Locomotive Works Record No. 81-1915, describing the Triple Articulated Locomotives of the Erie Railroad.—'In a tonnage test on the Erie Railroad, the locomotive hauled a train of 250 loaded cars, with a dynamometer car, from Binghamton to Susquehanna, a distance of 23 miles. The total length of the train was 8,547 ft., or 1·6 miles and it weighed, exclusive of the locomotive, 17,912 U.S.-tons. The grades between the two stations are gradually ascending; at one point there is a 5 deg. curve (about 17½ chains radius) in combination with a grade of ·09 per cent. (1 in 1,111). The train was assisted by pushing locomotives at the start, this precaution being taken to avoid pulling out drawheads. A maximum speed of 14 miles per hour was attained on the run, and the highest drawbar pull as registered by the dynamometer car was 130,000 lb.' This Erie train was 49 cars longer than that of the New York, New Haven and Hartford train, and 312 tons heavier than the train recently run over the Virginian Railway, so that I believe it still holds the record for length and weight of freight trains."

A Mersey Railway Steam Locomotive in Colliery Service.

On this page is reproduced a photograph by Mr. J. Macartney Robbins, of Shipley Colliery locomotive *Cecil Raikes*, and Mr. R. H. Ferens, of the Shipley Colliery, has supplied the following information:—"This engine was bought from the Mersey Railway Company in 1903 at the time of the electrification of their line. It was one of a 0–6–4 (side tanks with condensers for tunnel work) class of locomotives, built for them by Messrs. Beyer, Peacock & Co., in 1885.

"*General Description.*—The engine has inside cylinders, six wheels coupled and four-wheel bogie under trailing end, with double main frames. The driving axle has inside and outside bearings only; the coupling rods have outside cranks, steam brake (and ejector for vacuum brake on carriages when bought), and steam reversing gear.

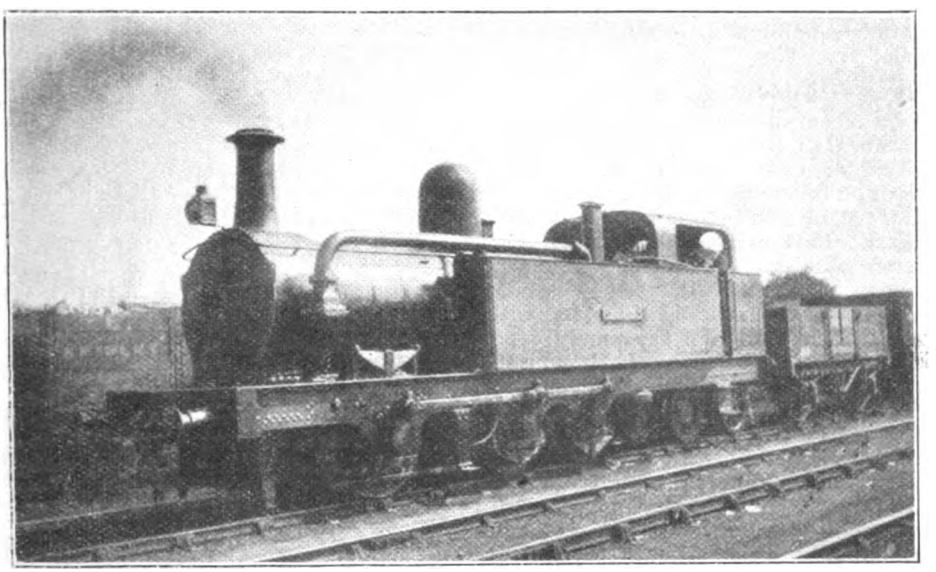

Photo.] [*J. Macartney Robbins.*

SHIPLEY COLLIERY 0-6-4 TANK ENGINE "CECIL RAIKES."

DIMENSIONS.

Cylinders (when bought), 21 ½in. diam., with 26 in. stroke.
Coupled wheels, 4 ft. 6 in. diam.
Bogie wheels, 3 ft. diam.
Boiler, 14 ft. 2 in. by 4 ft. 6 in. diam.
Copper firebox, 6 ft. by 3 ft. 5½ in. wide at bottom by 5 ft. 7 in. at front and 5 ft. 1 in. at back.
Heating surface in firebox and tubes, 1,580 sq. ft.

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Grate area, 20¾ sq ft.
199 steel tubes, 2 in. diam. by 14 ft. 5½ in. long.
Working pressure per sq. in., 140 lb.
Capacity of water tanks 1,250 gal.
Fuel capacity, 2 tons.
Gauge, 4 ft. 8½ in.
Height from rail to centre of drawbar, 3 ft. 5 in.
Height from rail level to top of chimney, 13 ft. 6 in.
Extreme width of tanks, 8 ft. 3 in.
Extreme length over buffers, 38 ft. 9 in.
Weight in working order, 68 tons.

"A cab was fitted by us for protection for the driver and fireman from the weather. The engine gave extremely good service with the old boiler and cylinders up to November 12, 1915. It was afterwards rebuilt by us and fitted with a new boiler and new cylinders, 21 in. by 26 in., with which it is now running and working the heaviest traffic."

Railway Organisation.

AT a recent meeting of the Great Western Railway (London) Lecture and Debating Society, Mr. Charles Travis, M.Inst.T., read a paper on this subject, illustrated by lantern slides. Mr. F. W. Showers, F.S.I., Principal Assistant to the General Manager, Great Western Railway, presided over a large attendance.

Mr. Travis commenced his address with a few general remarks on the purely departmental system of railway organisation employed in Great Britain, and suggested that this had outlived its sphere of usefulness. He considered that future conditions would necessarily require the establishment of a more flexible form of organisation, and thought this could be effected by an entire separation of the operating, engineering and commercial sides of railway business, as evidenced by several reorganisations in recent years.

The lecturer next drew attention to the size of the four prospective railway groups and observed that, while in the case of the southern and western groups, there was not the same necessity for comprehensive reorganisation, the North Western and Midland and the Eastern groups, the systems of which would extend from London to the North of Scotland, would probably have to frame their organisation along divisional lines. In the case of the North Western and Midland group, the lecturer suggested that there might be two new divisions, making four in all, one additional division in England to meet the inclusion in the group of the Midland, North Staffordshire and Furness Railways, and one, possibly two, in Scotland.

On the basis of four divisions, he outlined a scheme of organisation with special reference to the operating side. He suggested that, at headquarters, the supreme head of the railway, possibly styled president or managing director, should have three chief officers, a general manager, a commercial manager, and a comptroller. Under the general manager there would be a chief mechanical engineer, chief civil engineer, general superintendent, statistical officer, staff superintendent, and the divisional managers. Under the commercial manager there would be a passenger traffic superintendent, a freight traffic superintendent, a stores superintendent and a development officer, and under the comptroller, the accountancy and financial departments. The divisional manager would be assisted by seven divisional chief officers, respectively entitled superintendent of motive power, maintenance engineer, signal and telegraph engineer, stores superintendent, operating superintendent, commercial superintendent, and statistical and development officer.

On this basis, the headquarters of one of the large grouped systems would comprise ten chief officers, and the other front rank officers would be the four divisional managers. In each of (say) four divisions there would be seven chief officers, making a total of 28, and with the first rank officers, 42. At the present time, the chief officers in the operating and engineering departments of the constituent companies number 46, so that the proposed scheme would appear likely to effect economy in administrative cost. But organisation was a much bigger thing than that, and it would be most interesting to watch future developments.

Three Decades of Railway Progress in U.S.A.

THE "Slason Thompson" booklets issued by the Bureau of Railway News and Statistics, of Chicago, Ill., U.S.A., are always welcome in that a great deal of useful and interesting statistical and reference material is collected together in convenient form. The volume of statistics in regard to United States railways for 1920, now to hand, is prefaced by comparative tables showing the progress of U.S. railways during three decades. Naturally development is very much more marked than in a well-populated and established industrial country such as our own, but even allowing for this the figures given are notable. In the four years 1890, 1900, 1910 and 1920 the population totals were respectively 63, 76, 92 and 106 millions of inhabitants and the corresponding railway mileages 156,404, 192,552, 239,652 and 250,834. The last represents a mileage increase of 60·3 per cent. in 1920 as compared with 1890, the population increase being 67·9 per cent. In 1910

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railway operating revenue had risen from $1,051,877,000 to $2,787,266,000 as compared with 1890, the corresponding expenditure figures being $692,093,000 and $1,847,189,000. In 1920 increases in fares and rates account for the big rise in receipts to $6,300,160,000 (498·9 per cent. over 1890), and the heavy expenditure costs were $4,951,600,000, no less than 759·9 per cent. over 1890. The net revenue per mile of line, which rose from $2,300 in 1890 to $3,923 in 1910, had dropped in 1920 to $1,300. Numbers of passengers carried rose from 492,430,000 in 1980 to 1,253,396,000 in 1920; average number of passengers per train from 41 to 83; tonnage of freight from 636,541,000 to 2,305,190,000; and the average freight tonnage per train from 175 to 668, though the average haul had only risen from 119·72 miles to 181 miles. There were in 1920 about 67,000 locomotives, 55,000 passenger cars and 2,400,000 freight cars in service on United States railways.

Vacuum Brake Trials on the Great Northern Railway.

THESE were carried out in the summer of 1919 on the Great Northern Railway between Peterborough and Firsby, with a view to ascertaining the suitability of the vacuum brake for long freight trains, by Sir Henry Fowler, K.B.E., Chief Mechanical Engineer, Midland Railway, and Mr. H. N. Gresley, C.B.E., Chief Mechanical Engineer, Great Northern Railway. They were recently described by the authors in a paper read before the Institution of Civil Engineers.

The main differences between braking freight and passenger trains are:—(*a*) the greater length of freight trains; (*b*) the necessity of running loaded and empty wagons together in freight trains; and (*c*) even if screw couplings are used, the need of quickly coupling and uncoupling when shunting will probably result in the couplings being screwed up less tightly than in passenger trains. This tendency to couple loosely enhances the need for a smooth and uniform action of the brake throughout the train.

A number of improvements have been made in recent years in connection with vacuum brakes, including various forms of rapid-acting valves and accelerators. In the tests, the following conditions were laid down as a standard of satisfactory performance:—

That trains of 100 wagons, close coupled, must be stopped:

(1) By emergency applications without shock and without any risk of parting the train.

(2) By service applications without shock or risk of parting, and in such a manner that the train could be restarted immediately after coming to rest.

(3) That the speed of the train could be reduced as required.

The line between Peterborough and Firsby is very free from severe gradients and curves. The train consisted of Great Northern Railway 8-ton covered vans fitted with the Great Northern Railway standard vacuum brake, with the Westinghouse Brake Company's accelerators and reducing nipples. In addition to these the train included three Midland Railway six-wheeled vans carrying the necessary recording instruments. One of these was placed at the front of the train, one in the middle, and one at the rear. All the vans were unloaded and provided with screw couplings. The brakes were tested for leakage before the trials, and the travel of the brake pistons adjusted as required. The instruments comprised speed recorders and duplex vacuum recorders. The latter instruments (one of which was placed in the front, middle and rear vans) recorded the pressure in the train pipe and brake cylinder reservoir.

Trains of 63, 80, 82 and 101 vans were tested.

The general conclusions were as follows:—

(1) It is practicable with the vacuum brake to work long trains of up to 100 wagons, provided that suitable accelerators and reducing nipples are used.

(2) Emergency stops can be made without shock with trains consisting of up to 100 wagons.

(3) Service stops and speed reductions can be made and the train restarted promptly, provided that when running at speeds less than 30 m.p.h. air is admitted slowly so as not to operate the accelerators. This necessitates the braking being spread over some distance, but allows time to have the brakes partly released when the desired reduced speed is reached, or just before stopping, and thereby enables the train to get under way again almost immediately.

(4) It must be recognised that the provision of reducing nipples results in retarding the action of the brake and increasing the length of stops.

(5) In these trials the smoothest stops were obtained with the comparatively low working vacuum of 16 in. It is also easier to create and maintain this degree of vacuum than the usual 20 in., but the stopping distance in the case of emergency stops is, of course, increased.

Domed Locomotives on the Hull and Barnsley Railway.

IN view of the fact that for so many years the domeless boiler has been characteristic of Hull and Barnsley Railway locomotives, the accompanying diagrams and particulars of two classes which retain

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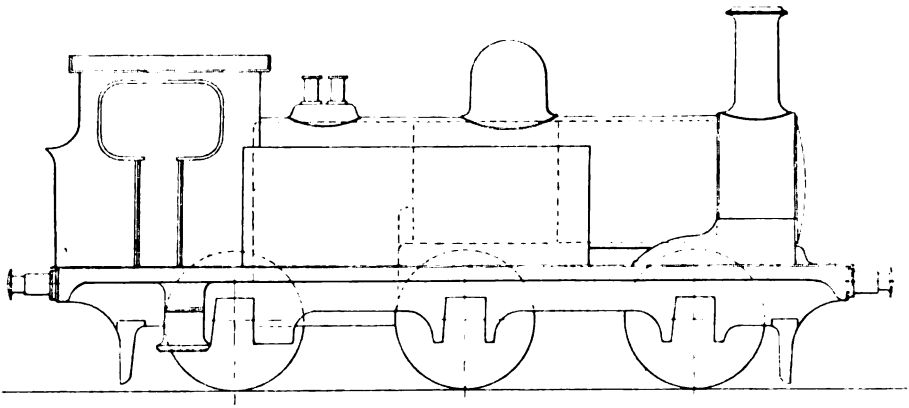


0-6-0 TANK ENGINE, CLASS G.1, HULL & BARNSLEY RAILWAY.

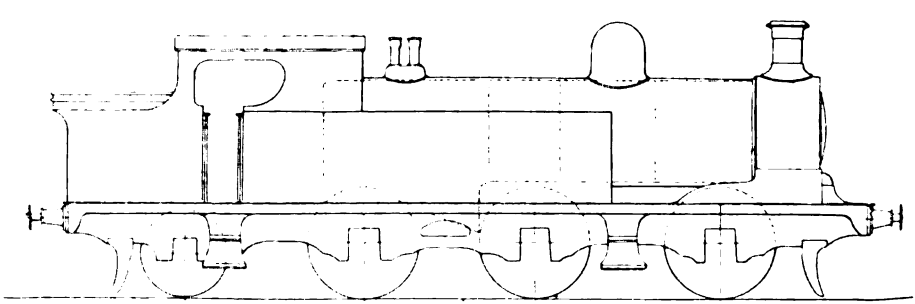
steam domes will no doubt be of interest. For this material we are indebted to Mr. Matthew Stirling, Locomotive, Carriage and Wagon Superintendent. Nos. 1–12, class "G.1" are 0-6-0 side tank engines, and retain the engine boilers fitted when built in 1885 by Messrs. Beyer, Peacock & Co. Limited. Nos. 97–101 are 0-6-2 side tank engines, class "F.1," built for the Lancashire, Derbyshire and East Coast Railway (now Great Central Railway) by Messrs. Kitson & Co., and purchased by the Hull and Barnsley Railway before delivery.

Leading dimensions are :—

	0-6-0 T	0-6-2 T.
Cylinders ..	17½ in. by 24 in.	18 in. by 26 in.
Coupled wheels	4 ft. 6 in.	4 ft. 9 in.
Steam pressure	140 lb. per sq. in.	175 lb. per sq. in.
Weight in working order ..	42 tons 11 cwt.	58 tons 4 cwt.

The Indian Railway Gauge Problem.

At a recent meeting of the Institution of Civil Engineers, a paper on this subject was read by Mr. F. G. Royal-Dawson, M.Inst.C.E., Chief Engineer to the Indian Railway Board. In introduction, he pointed out that after 70 years of general railway development in India, the gauge problem still awaits solution, owing to the absence of a definite or consistent gauge policy in the past. In 1851, when railways were about to be introduced in India, 5 ft. 6 in. was adopted as the standard gauge, in preference to the English 4 ft. 8½ in., as affording greater stability than the latter; and the importance of uniformity of gauge for all Indian railways was insisted on. On 1863, after about 5,000 miles of railway had been constructed on the standard gauge with English capital on a sterling guarantee of 5 per cent., the Government of India decided that, having regard to the costly nature of the original lines, bona-fide feeder lines or tramways might be constructed on a narrower gauge as a temporary expedient, and replaced by standard-gauge lines when justified by traffic development. In 1869, owing to a demand for an extensive programme of railway construction on a cheap basis, the metre gauge was introduced as a permanent supplement to the standard or broad gauge, on the understanding that the gauges would be confined to definite areas, and that there should be no competition nor overlapping of interests. In 1889, in view of the expansion of the metre gauge, a Committee of railway men recom-



0-6-2 TANK ENGINE, CLASS F.1, HULL & BARNSLEY RAILWAY.

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mended that that gauge should be restricted to definite areas, also that feeder lines should be constructed on the same gauge as the parent line, but that anything of the nature of a link connecting with broad-gauge railways should be either constructed on the broad gauge, or so constructed as to be easily converted thereto These principles have, however, not been adhered to, the result being that at the resent time, with a broad-gauge mileage of 18,000, and metre gauge mileage of 15,000, not to mention 3,500 miles of narrower gauges, there is no longer any serious attempt to restrict the gauges to particular areas or spheres of influence.

After discussing various aspects of the gauge problem in India, the author argued that in the battle of the gauges the broad gauge must ultimately prevail, because

(1) the capital sunk in it is more than double that of the metre gauge.

(2) it now carries 80 per cent. of the total railway tonnage of India at remunerative rates.

(3) it is inherently more economical in working than the metre gauge.

(4) it has higher potential speeds than the metre gauge.

(5) it is susceptible of indefinite expansion.

To meet the argument that things have gone too far, that India has not a clean slate to start on, and that the metre gauge has come to stay, the author adduced figures showing that, compared with other countries, India is still comparatively undeveloped as regards railways, and therefore that it is not too late to devise means for ultimately eradicating the dual gauge.

In conclusion he outlined a policy framed by a former president and a former chief engineer of the railway board, and pointed out that it is not sufficient merely to frame a policy, but that legislative machinery is required to put it in force. For this purpose he proposes an enlargement of the Railway Act so as to include a section dealing with the gauge question, the principal object being to establish the 5 ft. 6 in. gauge as the standard gauge of Indian railways.

Banbury as a Railway Centre.

COMMENTING upon Mr. Dummelow's article published in the February RAILWAY MAGAZINE, Mr. E. Little, of Bicester, writes as follows :—

"On page 80 Mr. Dummelow mentions that Banbury is unsuitable as a frontier post for through traffic, and consequently trains and train crews as a rule work through to Leicester and Oxford respectively, or further. May I be allowed to point out that, whereas this certainly was the case in regard to the through cross-country trains in pre-war days, there are only two instances in which the north-bound trains are taken by Great Western Railway engines to Leicester, and the Great Central Company only works one train (on Sundays only) to Oxford. The trains in question are :—

"(*a*) Swansea–Newcastle express, which I was recently informed is worked by a Great Western engine (Gloucester shed) to Leicester, arriving there at 1.37 p.m., and returning with the corresponding south-bound train at 2.30 p.m. This engine is generally of the 2-6-0 ("43xx" class), an ideal type for the heavy road between Cheltenham and Kingham.

"(*b*) 9.5 p.m. Swindon-York through train, which is worked by a Swindon engine to Leicester, due in at 11.39 p.m. It returns with the 10.3 p.m. ex York (1.28 a.m. ex Leicester), arriving back at Swindon at 4.35 a.m.

"(*c*) On Sundays only the Sheffield–Swansea through train is taken by a Great Central engine (presumably belonging to Leicester shed) to Oxford, arriving there at 12.30 p.m., and returning with the corresponding north-bound train at 3.35 p.m.

"In connection with the working of through trains from the Great Western Railway to the Great Central Railway via Banbury, it may be mentioned that when the first through trains were inaugurated in 1901 they ran non-stop from Oxford to Leicester, and vice versa, the schedule for the 67¾ miles being 85 minutes. The engines employed were generally of the 2-4-0 double-framed type, numbered 69 to 76, and named after certain English rivers. During 1902–03 I can recollect seeing the Great Central Railway 'Pollitt' single wheelers (4-2-2 type) working to and from Oxford, but they were soon replaced by the Robinson 4-4-0 type, and by the 'Atlantics.' For a town of its size and importance one would have difficulty in finding a centre much better served by railways than Banbury."

Railway Electrification in South Africa.

PRE-WAR suggestions for extensive conversion to electrical operation of the railway of the Union of South Africa have now crystallised into a definite programme and a start is being made with the electrification of the Glencoe-Maritzburg Section of the Natal Line. In June, 1919, Messrs. Merz & McLellan submitted a comprehensive report covering electrification schemes for (1) Capetown to Touws River, and Capetown Suburban lines; (2) Glencoe–Durban and Glencoe–Vryheid East; (3) Witbank–Germiston–Randfontein and Witbank–Komatipoort. From this report it was apparent

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that the most pressing case was the Glencoe–Durban Section, and particularly the 120-mile Glencoe–Maritzburg, as beyond Maritzburg conditions had been made easier by extensive deviations. The whole of the mineral traffic of the important Natal Coalfields, for which Glencoe is a collecting centre, passes over this line on its way to the coast at Durban, and for many years the mountainous stretches of country between Glencoe and Maritzburg had been a veritable bottle's neck, with the limit of steam traction possibilities reached.

Important economies will be effected by the introduction of electric locomotives. Assuming a loaded traffic of 20,000 tons per day in one direction on a 1 per cent. up grade, 11 electric trains, each of about 1,800 tons, would be capable of this duty, for which 14 steam trains would have to be employed. A valuable feature of electrification in these hilly districts will be the characteristic of regenerative braking on descending grades, obviating all the wear and tear on wheels and brake shoe inevitable with steam traction. This electrification will be one of the most important hitherto undertaken, comparing in this respect with the Chicago, Milwaukee and St. Paul undertaking, the locomotives being designed to take a continuous current supply of energy at a pressure of 3,000 volts on the trolley line. It is understood that the first order placed for this contract, amounting to between £750,000 and £1,000,000, has been secured by The Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, in face of the most strenuous European and American competition.

The Buxton Boiler Explosion.

THE report to the Minister of Transport in regard to the fatal accident that occurred on November 11 last, through the bursting of a boiler of a locomotive engine, at Buxton, London and North Western Railway, has been issued. The conclusions arrived at were that the explosion was due to considerable over-pressure, and not to any weakness of the boiler; that the explosion originated in the fire-box crown, and that there were probably several contributory causes which prevented the safety valves from relieving the excess pressure, the main contributory cause being the small amount of clearance between the valve webs and the seats when cold. In regard to a suggestion which had been current that the explosion might have been due to the presence of an explosive in the fire, the report states that not only is there a total absence of evidence to support this theory, but that the nature of the damage and the course of the explosion were both decidedly at variance with it.

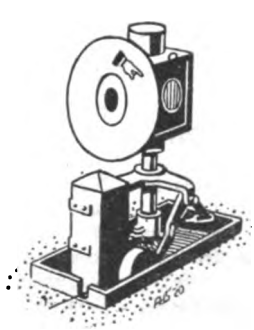
The following recommendations are made:

(1) That the final machining or fitting of the safety valve bushes should be done after they are driven into their seats, and that the valve webs should be finished to a standard and known clearance of the bushes.

(2) That whenever a steam pressure gauge is changed at the running sheds the new fitted gauge should be tested against the safety valve of the engine. It would facilitate this operation if a cock were fitted on the gauge pipe to obviate the necessity of letting down steam in the boiler.

Coventry and Leamington Section, London & North Western Railway.

COMMENTING upon the "Pertinent Paragraph" on this section published in the February number, Mr. A. P. Miall points out that double line commences at Gibbett Hill towards Coventry, there being single track in the Leamington direction. There is also a double line from Berkswell to Leamington direct.



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Mr. E. A. Watson has resigned the position of Chief Mechanical Engineer of the Great Southern and Western Railway (Ireland) to take up that of General Manager and Engineer-in-Chief with Beyer, Peacock and Co., Limited, Gorton, Manchester. Mr. Watson began his railway career in America, first with the American Locomotive Company of Schenectady, and later with the Pennsylvania Railway at Altoona. Returning to England, he joined the Great Western Railway at their Swindon works as Assistant Works Manager, later crossing to Ireland to take up the position of Works Manager at the Great Southern and Western Railway works at Inchicore. He subsequently became Chief Mechanical Engineer.

* * *

Mr. T. Brown, for many years principal Assistant to the Superintendent of the Line, London, Brighton and South Coast Railway, died suddenly on February 6, at West Croydon Station. Mr. Brown began his railway career as a youth with the North Eastern Railway at Alnwick and joined the service of the London, Brighton and South Coast Railway in 1859 as a telegraph clerk. He subsequently became Chief Assistant to Mr. Williams, Mr. John Richardson, and Mr. David Greenwood, respectively. Mr. Brown, who retired in 1907, was in his 82nd year.

* * *

The Chairman of the Irish Railway Clearing House for the year 1922 is Sir William J. Goulding, Bart., D.L., chairman Great Southern and Western Railway.

* * *

It has been necessary to alter the date of the Railway Benevolent Institution Anniversary dinner from Wednesday, May 3, to Tuesday, May 9. The function will be held at the Hamilton Hall of the Great Eastern Hotel, Liverpool Street, London, E.C.

* * *

At the recent annual dinner of the members of the Euston branch of the Railway Clerks' Association the guests included Mr. Arthur Watson, General Manager, London and North Western Railway. This is the first occasion on which the premier official of a great railway has been present at such a function. Mr. A. W. Page (Branch Chairman), of the D.S.O., at Euston, took the chair, and in a few happy phrases emphasised the necessity of maintaining the spirit of goodwill amongst all men. Mr. George Ridley, in proposing "The Railway Services," referred to the time when the progressional element in the railway world was hardly discernible; when men of good ability could find no scope in the employ of railway companies and left that service for the wider commercial life. The times now, he thought, were different, and he hoped the day had now dawned when the railway companies would make proper use of all their staff so that all associated with the railway service would pull together to

Elliott] [*& Fry.*

MR. E. A. WATSON,

General Manager and Engineer-in-Chief, Beyer, Peacock & Co., Ltd.

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make it the most efficient of all services in the country. Mr. Arthur Watson, in reply, thanked Mr. Ridley, and remarked that the chairman's opening address respecting goodwill was very appropriate, and it was in that spirit he hoped the railway service would be run. Goodwill must exist from the highest to the lowest, and providing that was attained there was little doubt the "Road to Efficiency" (the words appearing on the outside of the programme) would be trod. First and foremost on the "Road to Efficiency" was complete sympathy existing between all heads and all those who moved under them. Without that men could not put forth their best efforts, which all must do to make the railways a success. To obtain efficiency all must interest themselves in the service in which they obtained their livelihood, whether the position held by a person be general manager or office boy. Some people had told him the railways were a dying industry, but this he did not believe. With the present competition of road transport (which he still maintained was on an unfair basis) there was the necessity for diligent work to place the railways on a good footing. This could be done, and he was sure it would be done.

* * *

AT the annual general meeting of the Railway Club members at their headquarters, 65, Belgrave Road, S.W.1, on February 10, Mr. Cecil J. Allen made his initial address as president of the club. The hon. secretary announced that supporting Mr. Allen as president there were two past-presidents—Rev. W. J. Scott, B.A., and Mr. W. Parker, also three vice-presidents—Lord Monkswell, the Duke of Saragosa and Mr. A. R. Bell. The following officers were elected: Hon. Secretary, Mr. H. L. Hopwood; Hon., Treasurer, Mr. K. Ffitch; Hon. Librarian, Mr. H. W. Bardsley; Hon. Steward, Mr. M. D. Greville; Hon. Assistant Secretary, Mr. C. W. MacLeod. The executive committee elected were: Messrs. A. W. Bartlett, B. M. Bazley, T. F. Covington, N. B. Foster and E. J. Miller. After the business proceedings were concluded the latter gentleman gave an excellent lantern lecture on the "Standard Gauge Railways of Switzerland." On Friday, March 10, at 7.30 p.m., Mr. A. St. George Walsh will present a paper, the subject of which will be "Passenger Train Formation on the London and North Western Railway."

* * *

A TOUR which is advertised in this issue of the RAILWAY MAGAZINE and offers a week in the Isle of Wight—hotel accommodation, motor and other excursions, and rail fare from London all included—for £5 5s., should make a particular appeal to railway officials, especially as allowance of the rail, &c., fare will be made by the organisers to the holders of free passes. In such cases, it means that for the sum of roughly £4 7s. 6d. (plus 1s. per day for "tips," conductor's fees, &c.), a holiday for one week may be had giving: (1) Accommodation and board at the principal hotel of Cowes, the world-famed yachting resort; (2) motor excursions to Ventnor, Blackgang Chine, Sandown, Shanklin, Carisbrook Castle, Newport, Whippingham Church, and Osborne House. In the evening concerts and whist drives, &c., are to take place in the hotel, and members of the party may, at their own expense, run over for the evening to Ryde, where military and other bands are engaged at different times during the season. There is a char-a-banc service in the evenings, and the fare is very low. Among the attractions may be included yachting, golf, tennis, boating, bathing and fishing. The first departure is Easter, and the tours will, it is hoped, be run regularly thereafter throughout the season. The organizers are Messrs. Frame's Travel Agency, 92, Southampton Row, London, W.C.1.

* * *

ON February 8 and 9 the third performance of the Dramatic and Operatic Section of the T.O.T. Philharmonic Society was given at King's Hall, Covent Garden, when a performance took place of Edward German's opera "Tom Jones." The first performance by this section took place in January, 1921, when three one-act plays and Gilbert and Sullivan's "Trial by Jury" were performed. At the present time the company numbers about 60 members and is recruited almost exclusively from the London Underground Electric Railways and associated staffs. As at the previous performances of the Dramatic Society, the operas were produced under the personal direction of Mr. Emil Hardy. The dances were skilfully arranged by Miss Norah Webber and the musical side is the result of the joint efforts of Mr. Ewart Beech, who attended to the choral work, and to Mr. C. F. Lambert, under whose direction the orchestra—numbering some 40 performers—have reached their present high level of efficiency. Unlike most amateur productions, this excellent performance is the result of only a very small number of rehearsals. An interesting feature of the programme was the playing by the orchestra of a Grand March entitled "Floronzo," which was composed and conducted by Mr. E. J. Jordan, an omnibus conductor, attached to Dalston

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Garage, who is a member of the T.O.T. orchestra.

* * *

AN ordinary meeting of the Newcomen Society will be held on March 1, at 5 p.m., at Caxton Hall, Westminster (Station, St. James's Park), when a paper will be read by Mr. Robert Young, M.I.Mech.E., on "Timothy Hackworth and the Locomotive."

* * *

MR. S. WALLACE, commenting upon the "Pertinent Paragraph" on "Three-coach Express Trains," mentions instances he has recently noted. On January 3 last a portion of the North Wales express arrived at Euston, No. 1792, *Staghound*, having a load of three coaches only, one a dining car. Shortly after, a 2-4-0 No. 1682, *Novelty*, arrived with the second portion of the up Manchester express due at 9.20 p.m. with a four-coach train "an ideal load for a 'Jumbo.'"

* * *

WITH reference to the fire at the North British Railway High Street goods station, Glasgow, a number of newspapers stated that the loss to the railway was estimated at £800,000. We understand that this estimate was greatly exaggerated. The building cost nearer £50,000 than £500,000, and the railway company is not responsible for the warehoused stock, but simply lets space to tenants who are responsible for their own stock, and would, no doubt, cover their fire risk by insurance. For goods in transit, so far as not under owners' risk, the company may be responsible, but it would appear that £100,000 is a high estimate of the loss to the North British Railway.

* * *

"AUTO-TRAINS," or "push-and-pull" trains, have just made their first appearance on the Lancashire and Yorkshire section of the London and North Western Railway, a service having been inaugurated on February 6 between Manchester (Victoria) and Atherton, operated in this way. The engines employed are Horwich-built 2–4–2 tank engines, and the vehicles are modern elliptical compartment stock, in two-coach sets, each of which consists of composite brake with driving compartment, and eight-compartment third. The engines are allowed to push a maximum of six of these bogie coaches, but the normal load is one of four cars, which the engine pulls to Atherton and pushes back to Manchester. An ample service of trains is provided throughout the day, affording travelling facilities through a populous area that will doubtless be greatly appreciated and well patronised.

LONDON & SOUTH WESTERN RAILWAY.

Waterloo–Southampton train passing Raynes Park. 4-4-0 locomotive, No. 302.

* * *

IN connection with the recent Scottish Motor Exhibition the London and North Western and Caledonian Railways ran a

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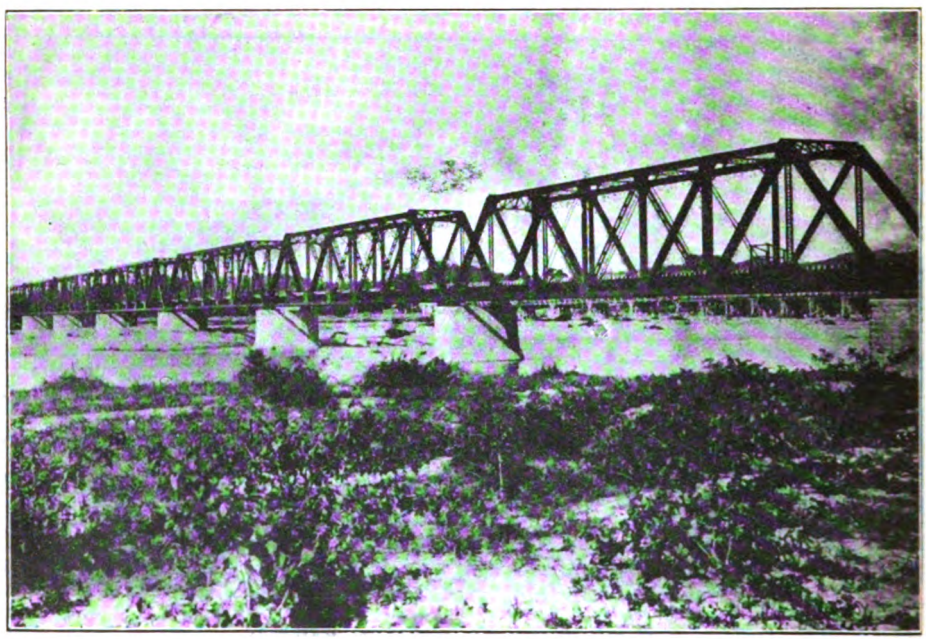
special train of 22 vehicles containing 28 motor cars and chassis, from Coventry to Glasgow. A second train was run three days afterwards consisting of 29 vehicles carrying 33 motor cars. In both cases the journey was performed in just over twelve hours, delivery of the motor cars being effected shortly after arrival of the trains. Under the new London and North Western Railway organisation the arrangements were made with the traders by the Commercial Department, and gave great satisfaction all round.

* * *

A SIXPENNY booklet issued by the Gray's Inn Press Limited, 25, Euston Road, N.W.1, and entitled "The Reorganisation of British Railways," reaches us as we go to press. The booklet is explanatory of the Railways Act, 1921, and consists of notes and observations mainly for the information of the staff employed in the railway service of Great Britain. To those engaged in the railway service the information given with regard to those provisions of the Act which relate to the methods of amalgamation and absorption, the machinery which has been established for dealing with questions relating to conditions of service, the superannuation and staff benefit funds, the compensation payable to those who may be displaced or prejudicially affected by the reorganisation and other matters connected therewith, will be very valuable, and this is supplemented by the inclusion of several useful appendices.

* * *

A further eleven 4-6-0 "Prince of Wales" class locomotives have been delivered at Crewe by Messrs. Beardmore and Co., viz., Nos. 435, 436, 438, 440, 442, 443, 452, 483, 489, 490 and 284. These engines bear Dalmuir Works Nos. 224–234 inclusive, in the order given. As intimated in the December, 1921, RAILWAY MAGAZINE, the naming of the passenger engines is now being proceeded with. Those so far dealt with—all of the four-cylinder "Claughton" class—have been named as follows:—Nos. 1407, *L.-Corpl. J. A. Christie, V.C.*, 2035 *Private F. Sykes, V.C.*, 1097 *Private W. Wood, V.C.*, 2427 *Duke of Connaught*, and 2373 *Tennyson*. No. 207 of the same class, which was named *Sir Charles Cust* temporarily for the Royal Train working on October 8 last, and which has since continued to run as such, has now been named permanently as above. No. 2577 *Etna* ("Precursor" class) has been superheated with extended smokebox and piston valves, and is now similar to the "George the Fifth" class. The 4 ft. 6 in. 2-4-2 tank No. 284 has been sold to the Wirral Railway



ARAKAWA BRIDGE, SHIBATA LINE, JAPANESE GOVERNMENT RAILWAYS.

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Company, while Special DX goods No. 3428 has been broken up.

* * *

SIR J. A. F. ASPINALL will deliver the James Forrest lecture at the Institution of Civil Engineers this year. He will deal with the subject of transport and particularly with the electrical aspect thereof.

* * *

COMMENCING Monday, February 6, important alterations were made in the Great Northern Company's train service, and certain of the trains between King's Cross and Scotland were accelerated. The sleeping car expresses now leaving King's Cross (Saturdays excepted) at 7 p.m. and 7.10 p.m. for Perth, Inverness, Dundee and Aberdeen, are combined, and start at 7.30 p.m., the journey being shortened by 30 minutes in each case. The 7.15 p.m. King's Cross to Hatfield, Luton, Dunstable, Hertford, St. Albans, Hitchin and Cambridge, now start at 7 p.m. and runs earlier throughout and the 8.25 p.m. King's Cross to Edinburgh calls at Newark and Retford daily. The 5.40 p.m. dining car express from King's Cross has a new connection for Keighley, involving one change only and being due to arrive there at 10.42 p.m. On Sundays the 11.30 a.m. dining car express from King's Cross is accelerated to reach Edinburgh 15 minutes earlier than formerly, and makes a new connection for Glasgow. The 11.30 a.m. dining car express from Edinburgh to King's Cross now starts from Glasgow at 9.55 a.m., leaves Edinburgh 11.15 a.m. and is due to arrive at King's Cross at 8.15 p.m.; this is an acceleration of half-an-hour.

* * *

A BATH correspondent writes that the placing in service of the new 2-6-0 Great Western engines of the "7300" class has been followed by the regular employment of this type- at any rate since early in January until the first week in February—on the 7.30 a.m. semi-fast train from Paddington to Bristol and Weston-super-Mare. For a long period this train was regularly hauled by one of the large 4-6-0 engines—either of the four-cylinder or two-cylinder type. During the winter months this train is comparatively light—a circumstance which doubtless explains the recent change to a large extent.

* * *

WE are advised that the International Locomotive Association has been formed "for the study and preservation of railway and locomotive working and progress." The society is located in North America, and may be regarded as a companion to the Railway and Locomotive Historical Society of which particulars have already been given, though it is independent. The organisation committee consists of Mr. A. Curran, 16, Ballard Street, Newton Center, Mass.; Mr. C. B. Chaney, 97, Lafayette Ave, Brooklyn, N.Y.; and Mr. Norman Thompson 346, Spence Street, Winnipeg, Man. Canada, any of whom will be pleased to hear from British railwayists who may be interested.

* * *

AT the third meeting of the seventh session of efficiency meetings held at the L.G.O.C. Training School, Milman Street, Chelsea, Mr. H. E. Blain, C.B.E., Assistant Managing Director, presided over an attendance of nearly 300 members of the administrative and control staff of the allied companies. The paper, "Lessons to be learned from Railway Accidents," was read by Mr. E. G. Harrison.

* * *

ONE of several special trains which the Caledonian Railway ran between Glasgow and Edinburgh in connection with the Rugby International was a notable innovation in railway travel in Scotland. It consisted of seven Pullman coaches, including the well-known buffet cars, *Flora Macdonald*, *Mary Carmichael*, *Mary Hamilton*, and *Lass o' Gowrie*, and the observation car, *Maid of Morven*. The train, which was completely filled, every seat having been booked several days ahead, left Glasgow at 11 a.m., and returned from Edinburgh at 7.5 p.m. This is the first occasion on which a train entirely made up of Pullman cars has been run in Scotland.

* * *

SECOND-CLASS has been abolished on the County Donegal Railways Joint Committee, Strabane and Letterkenny Railway, and Midland Railway (Strabane and Derry Section), as from January 1, 1922, and there are now only two classes on these lines, viz., first and third.

* * *

GREAT WESTERN RAILWAY signal statistics show that there are now in use 1,645 signal boxes, 594 ground frames, 21,600 signals, 9,200 independent discs, 11,310 points, 3,428 facing point locking gear sets, 48,280 working levers, 657 level crossing gates operated from signal boxes, 641 level crossing gates protected by locking or signals, 433 weighted fouling bars, 186 detonator laying machines, 2,042 emergency detonator placing machines, 570 electrically worked signals, 870 track

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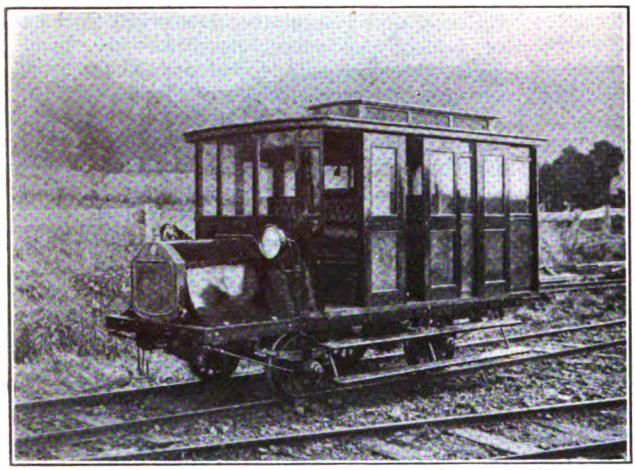


THE BERLIET RAIL CAR.

circuits, 29,289 long burning lamps, 10,850 telephones, 4,460 portable accumulators, and 71,000 accumulator re-charges were made.

* * *

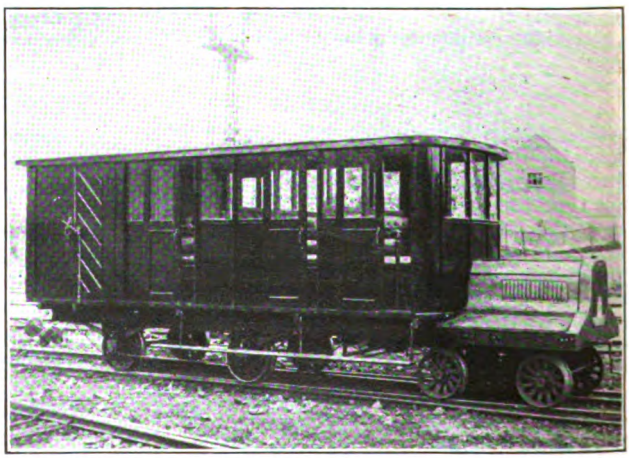
FIFTY years ago the preliminary surveys on the route of the extension of the Somerset and Dorset Railway from Evercreech to Bath were being performed, and the expectations of the value of the new connecting link between the North and South of England were high indeed. It was confidently expected, according to one contemporary, that before Christmas, 1873, the North mail would be able to run from Plymouth to Carlisle over this route without change of carriage, and that cargoes of fruit, fish and other perishable goods would be in the Midland markets within a few hours of being landed on the quay at Plymouth, "and this without the injury now caused by the break of gauge at Bristol." The construction of the new link was commenced early in 1872, but the above estimate of the time likely to be occupied was somewhat sanguine. The line was not opened till July 20, 1874.

* * *

THE borough councils of Rochester, Chatham, Margate and Ramsgate and the Chambers of Commerce of Bromley, Margate, Ramsgate and Folkestone have written to the London and North Western Railway Company asking for a through express in each direction between Manchester and Liverpool and stations in Kent.

* * *

THE use of motor vehicles, both for passenger traffic and other purposes on railways, is rapidly increasing, and by the courtesy of Mr. A. Richardson, Chief Mechanical Engineer of the Emu Bay Railway in Australia, we are enabled to publish illustrations showing two cars recently constructed at the company's workshops at Burnie, for use in passenger service on the Emu Bay Railway. The Berliet car is fitted with 15-h.p. four-cylinder Berliet engine, and has seating accommodation for 12 passengers. The body is finished in Tasmanian polished blackwood with sliding doors. The car is illuminated with a C.A.V. lighting set and can negotiate grades of 1 in 16, and run at 12 miles per hour. The Argyle car is fitted with 25-h.p. engine, and is used between Waratah and Guildford; it has seating accommodation for 16 passengers, and a box compartment at the back for carrying mails and baggage.



THE ARGYLE RAIL CAR.

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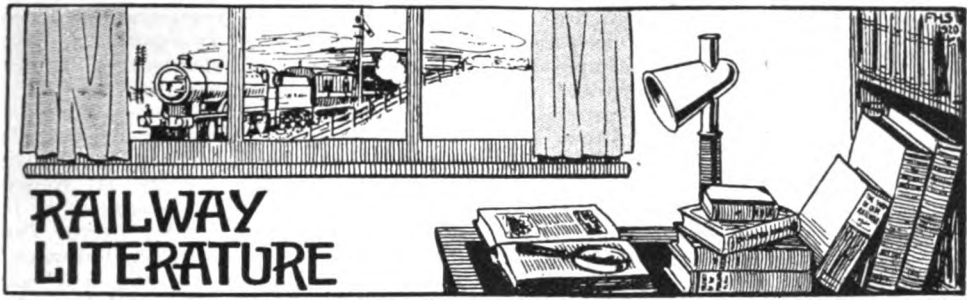

RAILWAY AND LOCOMOTIVE HISTORICAL SOCIETY, BULLETIN No. 2. Issued by the Society, of which Mr. C. E. Fisher is President, and Mr. R. W. Carlson, of 315, North 16th Street, Escanaba, Mich., U.S.A., is Corresponding Secretary, this Bulletin contains interesting historical articles on the Fall River Line Boat Train, one of the oldest trains in the United States, running regularly since 1847; the "Eddy Clocks," a famous class of locomotives on the Boston and Albany Railroad; experimental and historical locomotives of the Chicago and North Western Railroad; and "The Rival Builders" (the Taunton Locomotive Works and Mr. William Mason, also of Taunton), together with miscellaneous items. This Bulletin, together with No. 1, indicates that there is live interest in the United States in regard to locomotives and railway history and development, and no doubt the officers of the society will be pleased to hear from enthusiasts in this country.

THE PORT OF SWANSEA. Compiled and arranged by H. N. Appleby. [The Swansea Harbour Trust.] Issued by the Trustees, this handbook describes the dock facilities of the port and contains much other useful information. It is well-produced, freely illustrated, with portraits and particulars of the chief officers. Copies can be had by responsible applicants from the General Manager, Mr. P. W. Phillips, Swansea Harbour Trust.

JOURNAL OF THE PERMANENT WAY INSTITUTION, Vol. XXXIX. Part II of the *Journal*, apart from its records of the business of the Institution, includes a fully-illustrated report of the Annual Convention held in Belgium in June last, and articles on the reconstruction of the Belgian State Railways; replacing a large truss bridge (by Mr. J. Miller, B. Eng., Chief Civil Engineer, Great Eastern Railway, and President of the Institution); equating the work of permanent way maintenance; and mechanical locking. An obituary of Mr. A. G. Pugh, one of the early members, and for many years Librarian to the Institution, is included in the volume under review. Part III includes articles of permanent way and civil engineering interest, and one on the electrification of L. & S.W.R. suburban lines.

OIL POWER ENGINEERING. [Hogg & Knight, Limited, 149, Strand, London, W.C.2. Price 1s. monthly.] The first number of a new publication under this title is before us, and is a very creditable production. Oil power is now so much to the fore that there is every justification for a periodical devoted exclusively thereto. In an article entitled "Oil, the Fuel of the Future," reference is made to results obtained by Mr. James Holden on the Great Eastern Railway, and the factors which now govern the use of oil as fuel on steam locomotives are discussed.

RHODESIAN RAILWAY REVIEW. [General Secretary's Office, Bulawayo, Rhodesia. Price 6d.]

Described as the official organ of the Rhodesian Railway Workers' Union, this monthly publication is the staff magazine of the Rhodesian railway system. It is well produced, and includes many readable items, though these are usually of general and local interest. References are, however, included to matters affecting the railways and travel conditions in Rhodesia.

LEKTRIK LIGHTING CONNECTIONS. [A. P. Lundberg and Sons, 477-489, Liverpool Road, London, N. 7. Price 1s. net.]

This, the seventh edition of a well-known handbook, the sale of which has now reached the eightieth thousand, contains a wealth of practical data and useful information within its scope.

Messrs. F. C. Mathieson and Sons, of 16, Copthall Avenue, London, E.C. 2, send tables showing the distribution of net revenue for 1913 in regard to leading railway companies, compared with the distribution in 1920, under Government control and guarantee conditions, prepared for reference purposes in view of the resumption of publication of railway traffic statistics and the fact that the companies are again operating as private commercial concerns.

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THE SOUTH AFRICAN RAILWAYS AND HARBOURS SAFETY MOVEMENT AND FIRST AID GAZETTE. Indicative of the importance with which the "Safety Movement" and "First Aid" are regarded in progressive railway circles, this periodical shows how much interest the pages of a periodical devoted to these subjects may provide, besides the educational value of the articles included. The number before us, issued from the office of the Safety Movement, at the railway headquarters, Johannesburg, contains articles on the Welsh railway disaster, hints for signalmen, "Dont's" for wood machinists, "Practical Safety leads to Practical Economy," a review of a year's accidents on the South African railways, "What other railways are doing," St. John Ambulance Notes, and reports of the activities of local committees; together with short items designed to emphasise "Safety First" under various practical conditions.

MECHANICAL APPLIANCES FOR HANDLING RAILWAY TRAFFIC. By G. Bulkeley, A.M.I.Mech.E. (Great Western Railway). [*The Railway Gazette*, 33, Tothill Street, Westminster, S.W. 1. Price 5s. net.]

Based upon articles published in *The Railway Gazette*, this book will be welcomed by all students of railway-operating methods, and those concerned in the use of mechanical handling appliances. Earlier chapters deal with ordinary methods involving the use of wedges, jacks, purchases, hand cranes and winches, and the use of ropes, hooks and derricks. The author then proceeds to describe various portable appliances, stackers loaders and unloaders, and combined equipment, including forms of cranes, continuous conveyors, etc. Other chapters deal with telpher railways, runways, capstans, etc., dock working, and cartage, including motor vehicles providing special facilities to meet the needs of cartage traffic. A final chapter describes the working and equipment of a medium-sized goods depôt in detail. Well illustrated and with much useful incidental information condensed within its 132 pages, this volume is a useful addition to the practical handbooks now available for study by progressive railway officers.

JOURNAL OF THE INSTITUTE OF TRANSPORT. [Institute of Transport, 15, Savoy Street, Victoria Embankment, London, W.C. 2. Price to non-members, 2s. 6d.]

The January *Journal* includes, in addition to official notices, announcements, etc., full reports of the proceedings of the Institute in regard to papers by Mr. H. Kelway-Bamber, M.V.O., on "Possibilities of Improving Train Loads"; Sir George Paish on "The Future of British Railways"; Mr. W. A. Marsden, O.B.E., on "Some Aspects of Transport under Private and Government Control" (North-Western Local Section); and lectures to graduates and students by Mr. J. P. Thomas, on "The Operation and Development of Urban Electric Railway Services"; and by Mr. J. Paterson, on "The Operation of a Road Distributing System."

"MOUCHEL HENNEBIQUE FERRO-CONCRETE." A Handbook for Engineers and Architects. Fourth Edition. 524 pages. [*Ferro-Concrete*, 110, Cannon Street, E.C.4. Price 21s. net.]

This admirably produced and handsomely bound volume demonstrates the extremely varied uses to which Hennebique Ferro-Concrete has been applied in this country during the past quarter of a century. Part I. contains a general description of the principles underlying ferro-concrete construction, distinctive features of the Hennebique system, characteristics of ferro-concrete construction, etc. Part II. is devoted to illustrations and brief descriptions of different classes of structures, grouped in some 20 sections.

The Vaughan Crane Company, Ltd., of Openshaw, Manchester, send a copy of their new Hoisting Machinery Catalogue. It is well produced, handy for reference, and describes the following specialities in detail: Electric overhead travelling cranes, blocks and trolley hoists, overhead runway systems, wall jib cranes, electric or belt-driven self-landing hoists; and handpower overhead travelling cranes, pulley blocks and trolleys for overhead runways, overhead runway systems, and pulley block wall jib cranes.

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[*Photo : F. E. Mackay.*

BELFAST BOAT EXPRESS, LONDON & NORTH WESTERN RAILWAY.

4-6-0 Four-Cylinder Locomotive No. 194.

Containers on second vehicle for transfer to steamer at Fleetwood may be noted. The train is passing North Wembley.

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GREAT EASTERN RAILWAY STATION AT SOUTHEND.

Essex Coast Branches of the Great Eastern Railway.

By J. F. GAIRNS.

(*Photographs by the Author*).

A REMARKABLE feature of the Great Eastern Railway system is the number of sections which, owing to the large volume of traffic dealt with, and the number of trains which are operated separately from other services, may almost be regarded as main lines. Prominent among these are the Clacton-on-Sea and Walton-on-Naze and Southend-on-Sea and Southminster branches, with the Harwich line as a close follower up, apart from its importance as the section whereon most of the company's Continental traffic is concentrated. In addition, the Witham-Maldon and Woodham Ferrers-Maldon branches, and the Kelvedon, Tiptree and Tollesbury Light Railway are by no means unimportant sections of the system. Therefore, in selecting these branches for present consideration—that is, all the coast routes south of the Ipswich and Felixstowe line—sections of traffic are covered which figure very prominently in Great Eastern Railway train services all the year round, though at their greatest pressure during the summer months and at holiday periods, while, as will be seen, they include many items of general interest.

The oldest of these branches is that from Witham Junction to Maldon. This was opened in 1848 by the Eastern Counties Railway, at the same time as the corresponding branch from Witham to Braintree. The Harwich branch from Manningtree, opened in 1854, was built in association with the Eastern Union Railway. Harwich was for a time a centre for Continental traffic, but its real importance in this connection dates from 1883, when Parkeston Quay was built, deriving its name from Mr. Charles Henry Parkes, then Chairman of the Great Eastern Railway Company.

The Clacton line began in a very different form, the resort whose traffic now dominates the branch not being

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served until many years after the original Tendring Hundred line had been made. The first section was the short branch from Colchester to Hythe, made by the Colchester, Stour Valley, Sudbury and Halstead Railway, the remainder of whose system was some five miles distant, forming the present Sudbury branch from Marks Tey. The Tendring Hundred Railway extended this line from Hythe to Wivenhoe (1863), also building the branch from Hythe to St. Botolph's, Colchester, and in 1867, by the Tendring Hundred Extension Railway, reached Walton-on-coastwise branches of the Great Eastern Railway in Essex.

Having thus indicated the order in which these lines were added to the Great Eastern Railway system, they may be briefly described, and this will be convenient on the basis of the order in which they are encountered on a journey from London.

I.—The Southend Group of Lines.

When first opened in 1889 the Southend branch was double-track from Shenfield to Wickford, and at the latter station divided

SHENFIELD AND HUTTON JUNCTION.

Signals clear for down main line train. Southend branch trains diverge to the right. Up Southend trains can use either side of up island platform.

Naze. The Brightlingsea branch was constructed in 1866, being vested in the Great Eastern Railway in 1893. Then in 1882 the Clacton-on-Sea branch was made from Thorpe-le-Soken, with the result that in later years the Walton section has taken a secondary, though by no means unimportant, place. The Tendring Hundred and Clacton companies were vested in the Great Eastern Railway from June 29, 1883. The Southend group of lines, including the Southminster and Woodham Ferrers-Maldon branches, were opened in 1889. Finally, the Kelvedon, Tiptree and Tollesbury Light Railway was opened for traffic in 1904, representing the latest addition to the

to form two single lines, one to Southend and the other to Southminster, the latter diverging about a quarter of a mile beyond. There was also a connecting line enabling trains to be run through from the Southminster branch to Southend, avoiding Wickford. There was some idea of developing a through service between Southend and Chelmsford via Woodham Ferrers (at first known as Woodham Ferris), Maldon and Witham, and for a time the Maldon trains did run to and from Southend instead of terminating, as they do now, at Woodham Ferrers. This connecting line, of which only the hedge-lined route and a closed up signal cabin at one of the junctions can be traced, was

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taken up after a few years. From Wickford to Southend is now double-track, though the Southminster line remains single.

Taking the stations in order, Shenfield and Hutton Junction, to give it its full name, has an island platform on the up side, and usually trains from the Southend line come in on the outer side. They can, however, be directed to the up main line, and this enables an express train to interchange with a stopping train which may have arrived a few minutes in advance in order to collect passengers from stations which are passed by the through train, an arrangement which is by no means infrequent during the hours of business travel. At other times the side platform enables branch trains to be dealt with clear of the main line, there being sidings and an engine turntable to meet traffic needs.

From Shenfield the branch diverges fairly sharply, necessitating a severe speed order for non-stopping Southend trains, and after descending alongside the main line for some distance curves away on its run of 4 miles 16 chains to Billericay, passing Mountnessing siding on the way. Billericay, a growing residential district on its own account, has a modern station situated in a picturesque cutting, spanned by high road bridges east of the station. The route so far is by no means easily graded, and there are numerous curves, but this first stage affords a good indication of the smart running which is characteristic of train working on this section. For instance, some of the stopping trains are allowed only six minutes for the run of 4 miles 16 chains, start to stop. The next stage of 4 miles 50 chains to Wickford was similarly scheduled very tightly, six minutes being a usual allowance for down trains, start to stop; though in the opposite direction the harder gradients necessitate nine minutes being allotted.

Wickford has two long platforms, each with a bay at the east end, the usual practice being to bring branch trains from Southminster into the up side bay, to connect with up Southend trains, the branch departures being made from the bay on the down side. Branch trains can, however, be dealt with on either side, or on the through lines, and the station is very completely signalled. A turntable is provided at the west end of the station, where are situated the goods yard and cattle dock.

East of the station the Southminster single line parallels the double track to Southend for a short distance and then curves away towards Battlesbridge and Woodham Ferrers. Meanwhile, the Southend line continues to Rayleigh (4 miles 9 chains), Hockley (3 miles 3 chains), and Rochford (2 miles 42 chains), and on to Prittlewell (2 miles 16 chains), a growing suburb of Southend and itself a busy residential district. In fact, a notable feature of the traffic of the whole of this branch is the extent to which all these stations have developed on a residential basis, for which the very smart and generous train facilities afforded must be held largely responsible. Indeed, the smart engine working on this branch is very notable, for steep gradients abound, curves are numerous, and the 4-4-0 engines generally used have hard work to keep time with the heavier trains, which are usually also the fastest.

From Prittlewell is a short run of 49 chains into Southend, but on a steep rising gradient, past the extensive carriage sidings, the engine shed and the goods yard. The terminus has arrival and departure platforms, with engine line between, and two outside bay lines, all being long enough for the heaviest trains likely to be dealt with. Station premises, which are close to the Southend technical school and the main centre for the local tramway system, are well arranged, with good circulating spaces, refreshment rooms and other appurtenances of a modern terminal.

Before considering the train services it will be convenient to deal first with the Southminster and Maldon routes, as they contribute their quota to the traffic of the group of lines concerned. Leaving Wickford as a single line, the first station—Battlesbridge, 2 miles 40 chains—is non-crossing, having the platform on the up side. Thence to Woodham Ferrers (2 miles 45 chains) completes the section (controlled by train staff and tickets, as throughout the branch). Here there are only the usual two platforms, the Maldon branch trains terminating and reversing on the through lines, being placed in a siding

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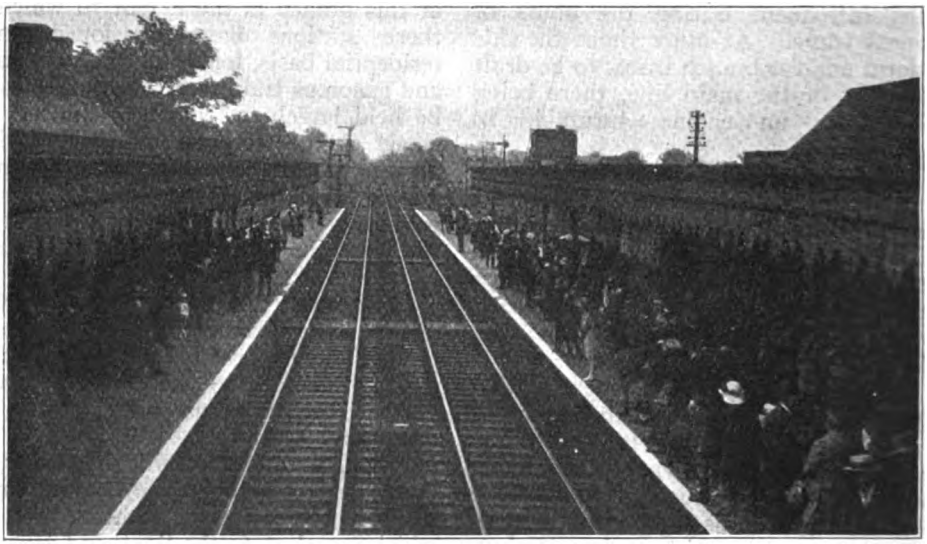
between journeys. From Woodham Ferrers to Fambridge (almost a rival to Burnham-on-Crouch as a centre for yachting on the Crouch, and used by many passengers who come down regularly every week-end), a distance of 3 miles 17 chains, is the next section. Althorne (3 miles 5 chains) is a non-crossing station, with its platform on the down side, and after passing Cricksea Siding, Burnham-on-Crouch is reached (2 miles 77 chains). This is the busiest station on the branch, Burnham being famous as the head-quarters of yachting on the Crouch, and a boat-building and industrial town on a small scale. At Fambridge the Crouch is interesting, but at Burnham it has attained considerable width, and during the summer months, especially at week-ends, its waters carry hundreds of sailing yachts and motor boats, besides being the scene frequently of regattas and racing and other events. From Fambridge to Burnham the railway train affords many views of the river, or it is possible to walk by the river side for the entire distance along an embankment or river wall erected to protect the low-lying lands from floods. From Burnham the railway turns inland for a distance of 2 miles 18 chains to the small country town of Southminster. Here is a single platform on the down side, with sidings, engine shed and goods yard. This is the least ambitious of all the stations on the branch, though it is by no means primitive. But all the others are well built on modern lines, with fairly long platforms, a full equipment of waiting room accommodation, and awnings of adequate length. Adjacent to each is a group of railway houses—they may almost be described as villas—provided for the railway staff, and most of which would excite the envy of a London householder of limited means. Built of red brick, with large gardens, they add much to the picturesqueness of the station surroundings.

The Maldon branch from Woodham Ferrers is rather less ambitious, but it has its interesting features. Cold Norton station is non-crossing, and the section extends from Woodham Ferrers to Maldon (West), a distance of 7 miles 21 chains. Here the station is of modern type. The remaining distance of 1 mile 33 chains to Maldon (East) and Heybridge (double track) consists mainly of a circuit of this busy town, which is also coming into favour as a holiday resort. Picturesque pleasure grounds are passed, and the Blackwater is crossed by a viaduct leading to the junction with the old line from Witham. Maldon station consists of one platform with a bay on the up side, and has somewhat imposing buildings, said to be due to the fact that, when the line was



A BUSY INTERCHANGE SCENE AT WICKFORD JUNCTION.

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first made in 1848, the then chairman of the Eastern Counties Railway was appealing to the electors of the district to send him to Parliament as their representative. Beyond the station the line continues to serve a wharf where shipping traffic on a small scale is dealt with, Maldon providing for access to Mersea Island and being the centre for yachting and shipping traffic in the estuary of the Blackwater.

At this stage the older line to Maldon from Witham Junction may also be mentioned. Leaving Witham on a sharp curve, the first station — Wickham Bishops—is non-crossing, while Langford must be regarded as little more than a halt with very limited accommodation. There is only one section, from Witham to the junction at Maldon with the line from Woodham Ferrers and Maldon (West), a distance of 5 miles 38 chains.

For many years following the opening of the Southend group of lines the Great Eastern Railway "lay low," as it were, in regard to train services. Good facilities were provided, and excursion traffic was developed, but the needs of business residential travel were sufficiently met by one good train up in the morning and one back in the evening or on Saturday afternoons, with one or two others giving alternative facilities on a slower basis. The expresses stopped only at Prittlewell and Wickford, with associated pick-up or distributing trains for the transfer of passengers using intermediate stations. The Southminster line, in view of the early favour of Burnham-on-Crouch and Fambridge as week-end yachting centres, had several through carriage services, and among the special items on that line was a Monday morning express which did not stop from Burnham-on-Crouch to Shenfield, where the vehicles were attached to an up main line train for London. According to the writer's recollection of twenty years or so ago, when he occasionally spent a week-end at Fambridge, two London engines usually worked down to Wickford for the Saturday afternoon traffic of the branch, relieving the branch engine and together maintaining the connections with Southend trains. One of these worked back on Saturday evening to London, the other staying over and working the Sunday trains, then taking the Monday morning through express to Shenfield, continuing through to London later. As these engines were usually old 0-4-4 tank locomotives, some interesting running performances were often put up for their type. There was also a half-day excursion train on Thursday afternoons from the Woolwich line through to Burnham and Southminster.

The usual Southend line engines in those days were the "420" class of mixed-traffic 2-4-0 locomotives, but the "700" class, with 7 ft. wheels, were sometimes seen, and interesting comparisons were often possible between the running capabilities of the two classes, either of which might be employed on the fast business expresses mentioned. The "1090" class of 2-4-2 tank engines with 5 ft. 8 in. wheels were also used, and some of them worked through from London, often on fast schedules. There were, particularly, two through trains from Fenchurch Street to Southend by this route. The 8.47 a.m. stopped at all stations to Forest Gate, and then only once (or twice) to Prittlewell. The 9.47 stopped at all stations to Ilford and then at Wickford only to Prittlewell. For a long period one was regularly taken by No. 1098 and the other by 1099.

In 1912, however, the Great Eastern Railway commenced seriously to develop the Southend line for residential traffic, Southend itself having extended considerably in the direction convenient to the Great Eastern station, while Prittlewell, Rochford, Hockley, Rayleigh, Wickford and Billericay were all growing to a degree which called for generous train service provision. As a result, season-ticket holders were given four or five really fast trains up in the morning, with corresponding returns in the evening or on Saturday afternoons, several arranged so that stopping portions in advance (in the up direction) collected for an express from intermediate stations, or were detached at Shenfield or Wickford on the down journey so as to give all stations approximately a half-hourly service during the period of demand. Restaurant cars also appeared, on a breakfast car train in the morning and a down supper car train at night, with intermediate trips as a tea car down and a supper car up in the evening. As the trains were becoming relatively heavy, and this branch is, on the

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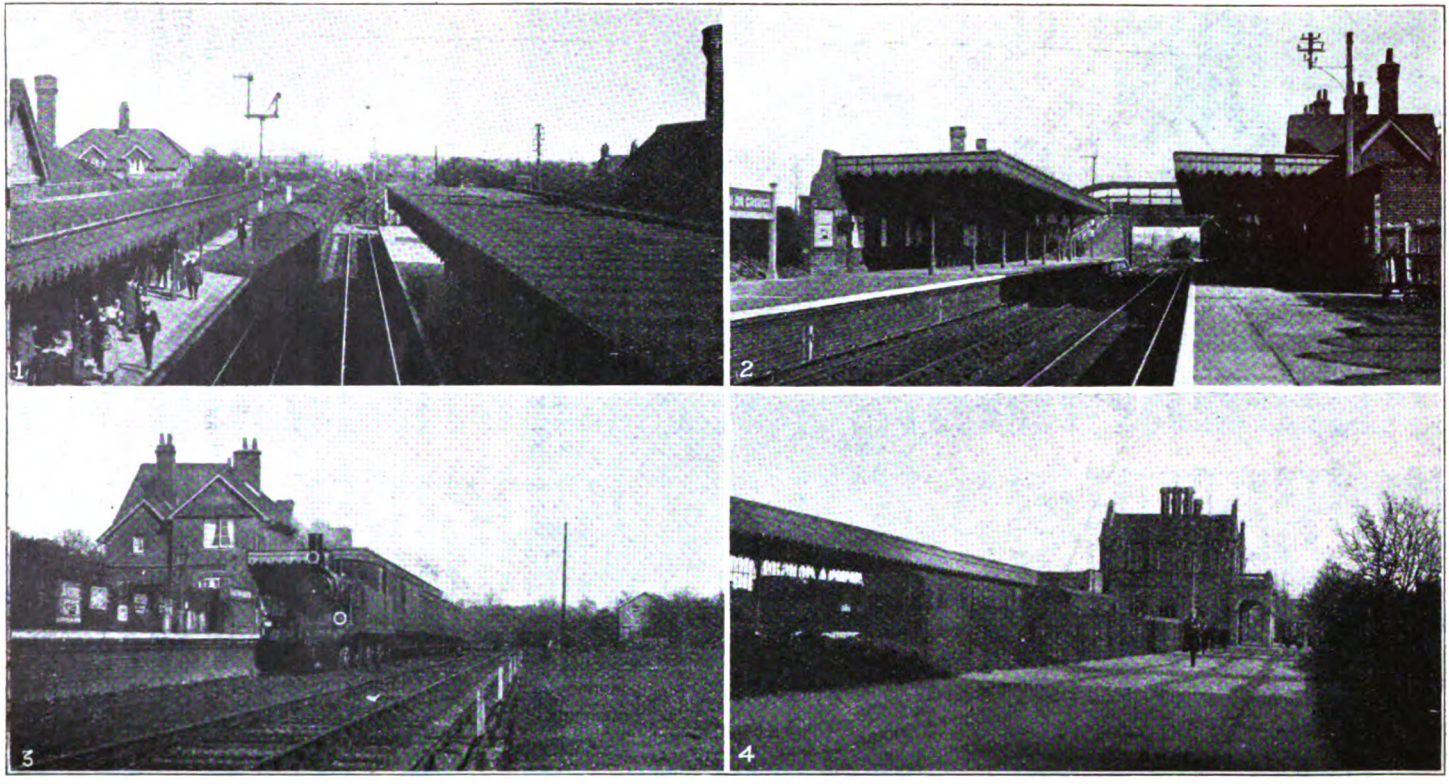

1. **WOODHAM FERRERS JUNCTION.**
Through train from Liverpool Street to Southminster diverging towards Fambridge.

2. **BURNHAM-ON-CROUCH STATION.**
Up train approaching, worked by 2-4-0 mixed-traffic engine.

3. **SOUTHMINSTER STATION.**

4. **MALDON (EAST) AND HEYBRIDGE STATION.**

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whole, steeply graded, and in view of the hard intermediate timings frequently involved, the "Claud Hamilton" 4-4-0 class of engines became the standard and are chiefly used still.

During the war period the service was not greatly reduced, but strike reductions and other influences have somewhat retrograded the service from its high-water mark of excellence. But the services now provided, particularly to meet the needs of business travel, are most creditable, as will be seen, and call for high-class work on the part of the engines employed. Indeed, the "Claud Hamiltons" now put up some of their best performances on the Southend line.

For early travellers the 6.16 a.m. up from Southend stops at all stations to Shenfield, and then at Gidea Park, but it covers the 41½ miles, with 8 stops, in 79 minutes. The 6.52 pick-up train to Shenfield is joined at that station with the 7.10 a.m. express, which stops at Prittlewell, Shenfield, Brentwood and Gidea Park, and yet reaches Liverpool Street at 8.23 a.m. The 7.18 a.m. is another pick-up, but this works as far as Brentwood, to connect with the 7.37 a.m. express which stops only at Prittlewell and Brentwood, reaching Liverpool Street at 8.45 a.m. The 7.47 a.m. is a through train, serving all stations to Gidea Park except Shenfield, and then stops at Stratford, reaching Liverpool Street at 9.14 a.m. This was, formerly a pick-up connection only, but is now run independently of the following 8.11 a.m. express, which stops only at Prittlewell and Brentwood, being due at Liverpool Street at 9.17 a.m., three minutes behind its predecessor. The 8.40 a.m. is the successor of the original morning express, but now gives Prittlewell, Rochford, Hockley and Rayleigh a special express, running hence non-stop and reaching London in 70 minutes. It now conveys also a third-class Pullman car, on which breakfast can be obtained if desired. The morning series is completed by the 9.16 a.m. up express, the fastest, running non-stop from Prittlewell to Liverpool Street in 61 minutes, due 10.17 a.m. In addition, there is a through train from Southminster at 8.8 a.m., which also gives Wickford, Billericay and Shenfield a fast train, and is non-stop from Brentwood.

In the opposite direction, the evening return service is, if anything, more generous. The 4.15 p.m. stops at Wickford, Rochford and Prittlewell, the complete journey taking 61 minutes. Branch stations are served by a connection from Shenfield off the 4.18 p.m. main line train. The 4.48 p.m. conveys the third-class Pullman car, but serves all stations from Shenfield onwards, though even then it is due in Southend at 6.4 p.m. The 5.18 p.m. fast train runs right through to Prittlewell in 57 minutes, reaching Southend at 6.19 p.m. The 5.39 p.m. calls at all stations from Shenfield, serving also the Southminster line. The 6.5 p.m. stops only at Shenfield and Prittlewell, due Southend 7.8 p.m. At Shenfield a slow portion is detached to follow for intermediate stations. The 6.26 p.m. calls first at Brentwood, and is followed from Shenfield by a slow portion, the main train stopping only at Rayleigh and Prittlewell, due Southend 7.38 p.m. The 7.10 p.m. stops only at Rayleigh and Prittlewell, due Southend 8.11. For later travellers the 8.2 p.m. reaches Southend at 9.8 p.m. (a slow portion is detached at Shenfield), the 8.45 p.m. at 10.5 p.m, (slow from Shenfield), the 9.45 p.m. at 10.47 p.m. (slow portion from Shenfield following), and the midnight train is due at 1.9 a.m. Throughout the day, however, trains are available at intervals rarely exceeding one hour. On Saturday afternoons the expresses take the following times for the complete journey: 12.0 noon (74 min.), 12.48 (67 min.), 1.20 (71 min.), 1.50 (63 min.), 2.30 p.m. (63 min.), 2.58 p.m. (68 min.). On Sundays the train service is also very much on the generous side, especially during the summer months. Special stress is, however, laid upon the completeness and convenience of the business trains which apply all the year round.

On the Southminster line there are now no fast trains, but besides the 8.8 a.m. through up train there is also a special through down train from Liverpool Street at 1.26 p.m. on Saturday afternoon (Billericay first stop), while 9 or 10 services each way on the branch give very complete facilities spread over the day, especially as many of them connect with fast Southend trains, and several include through carriages. The ordinary traffic

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of the branch is now worked by a 2-4-2 tank engine, assisted by Southend tender locomotives with through trains and making further trips required.

At present the service on the Woodham Ferrers-Maldon branch is somewhat meagre, consisting of 5 trains each way daily. Maldon is, however, also served for London traffic via Witham, adding a further 8 trains daily in each direction. This route is also worked by a 2-4-2 tank engine, the two branches from Maldon being shared by the two locomotives which work either as convenient in arranging their duties.

(To be continued.)

"PRAIRIE" TYPE LOCOMOTIVES IN AMERICA.

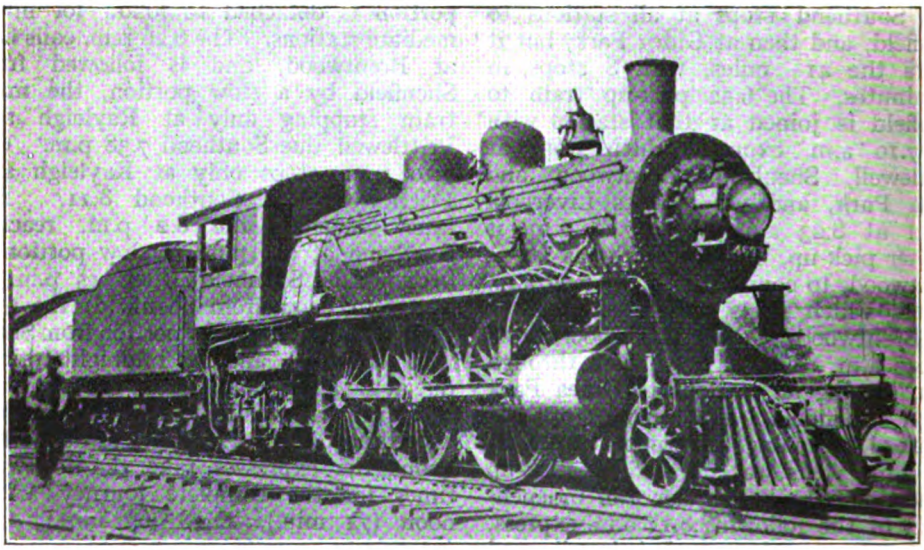

Photo.] [*A. Curran.*

LOCOMOTIVES of the "Prairie" or 2-6-2 type have never been very numerous, and Italy has probably had more than any other country; but in the United States a fair number of such engines were built in the early years of the present century, and some still remain in service. We are indebted to Mr. Arthur Curran for the photograph reproduced. The engine shown is a 2-6-2 built about 1903–4 for the Lake Shore and Michigan Southern Railway, rebuilt under New York Central Railway auspices with outside axle boxes to the trailing wheels, but retaining inside valve gear. Cylinders, 20 in. by 28 in.; coupled wheels, 6 ft. 8 in. diam.; heating surface, 3,356 sq. ft.; grate area, 48 sq. ft.; weight in working order, 190,000 lb.

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Locomotive and Train Working in the latter part of the 19th Century.

THE CAMBRIAN RAILWAYS. [No. I.]

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

THE main line of the Cambrian Railways starts at Whitchurch, in Shropshire, passes through Oswestry, the headquarters of the system, thence through Newtown to Glandovey Junction, where the line forks. The southern fork or main line proper, extends to Aberystwyth, and the northern fork follows the coast through Barmouth to Pwllheli. In its origin it may be likened to a number of pieces of string which were knotted together at the ends to form one long piece. There was also, prior to 1888, a branch line from Moat Lane Junction to Llanidloes, which made an end-on junction with the old Mid-Wales Railway. In 1888 the latter railway, until then a separate company, was amalgamated with the Cambrian Railways, and added a long branch line from Llanidloes to Tal-y-llin Junction, whence the trains ran over the Brecon and Merthyr Railway into Brecon. The new Wrexham and Ellesmere Railway opened in 1895, and worked by the Cambrian and also the small Van Railway taken over in 1896 complete, with the older Kerry branch, the account of the Cambrian system as it existed at the end of the nineteenth century.

The original "pieces of string" which went to form the main line, consisted of the Llanidloes and Newtown Railway, which was the first to be opened, the Oswestry and Newtown Railway, the Newtown and Machynlleth Railway, the knot in this case being tied at Moat Lane Junction, the Oswestry, Ellesmere and Whitchurch Railway, and finally the Aberystwyth and Welsh Coast Railway. They were opened between 1859 and 1863 as independent lines, and were finally tied together as the Cambrian Railways in 1864-5.

Most of the line was "single" from end to end, except the sections between Oswestry and Llanymynech, and between Buttington Junction and Welshpool, which had been doubled. The latter section had, in addition to the Cambrian trains, to accommodate the joint London and North Western and Great Western services between Shrewsbury and Welshpool.

Taking into account the fact that the line crosses a mountainous country the gradients may be considered to be comparatively moderate on the whole. There is a sharp rise of 1 in 80 at Frankton, beyond Ellesmere, for about 1¼ miles, followed by a fall of 1 in 80 of equal length, and thence a steady rise of three miles, most of which is at 1 in 103 to 1 in 110 past Whittington to Oswestry. From Oswestry there is a sharp fall for about three miles at 1 in 80 to 1 in 111, after which the line undulates. Before reaching Montgomery a steady rise commences, which culminates in the steeper ascent to Talerddig summit. On the west side of the summit the line falls very steeply for four miles at 1 in 60 to 1 in 52, and continues downhill almost the whole way to Machynlleth. The worst bits of this latter portion are at 1 in 78 to 1 in 90. Altogether the gradient is nearly 11½ miles long, and is certainly a most formidable obstacle to eastbound trains. For the remainder of the journey to Aberystwyth the gradients are easy except for two short and sharp rises and falls of 1 in 75 each about one mile long.

It is obvious that a long cross-country line of this description, nearly the whole of which was single, could hardly be expected to produce much in the way of express trains, and going back to the period of about 1880–5 it certainly did not. But it is fair to say that expresses would hardly have been a paying proposition, as the line passes through a thinly-populated country, and depended for through traffic upon the London and North Western connection at Whitchurch

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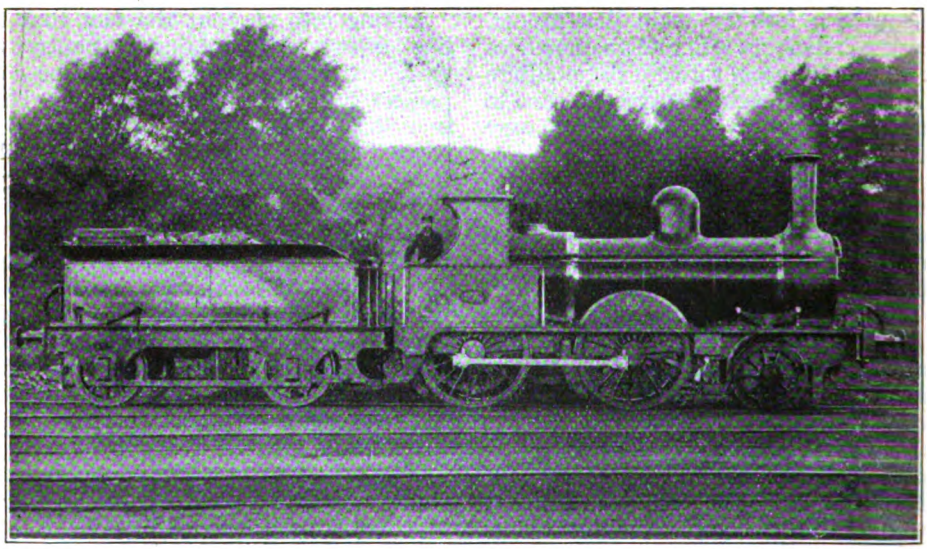
and the Great Western connection via Shrewsbury and Welshpool. These two large companies did not in those days provide all the facilities for good through trains that they might perhaps have done, and it was generally surmised that they had ulterior designs in the direction of the absorption of their small neighbour.

In respect to its long coast line the Cambrian had points in common with the Furness Railway, but without the advantage of a heavy mineral traffic upon which the latter could always depend. Summer tourist traffic was a feature of both railways, but when this was over the Cambrian had comparatively little upon which to fall back during the winter months.

In another respect the two lines were almost exactly similar. Neither company designed its own locomotives, but purchased them from Sharp, Stewart & Co., of Manchester, and the chief classes of engines, which this firm supplied to both railways, were identical. In those days most of the Cambrian engines had names, some of which were of an extremely unpronounceable character as befitted the Celtic country which the line traversed. Fortunately, unlike the broad-gauge engines of the Great Western, the Cambrian engines had numbers also, or there might have been a block on the line whilst the staff was wrestling with Welsh and classical orthography as depicted on the boilers of the engines.

Until 1878 there were only 12 main line passenger engines. When it was considered that the main line from Whitchurch to Aberystwyth has a length of 95¾ miles and the northern fork from Machynlleth Junction to Pwllheli provides 57¼ additional miles of main line importance, I often wondered how the company managed to work the passenger traffic over 153 miles of line with those 12 engines, one or two of which would be in the shops for repairs, though naturally repairs to passenger engines were taken in hand as far as possible during the winter months. Moreover, these passenger engines were of very small size, and the loads which they were capable of taking were limited accordingly.



2-4-0 PASSENGER LOCOMOTIVE No. 56, AS REBUILT AT OSWESTRY.
Coupled wheels, 5 ft. 6 in. diam. Cylinders, 16 in. by 20 in.

These engines were of the same 2-4-0 type as those of the Furness Railway, and were built in 1863–1865. For 13 years, therefore, they carried the whole burden. The cylinders were 16 in. by 20 in., and the coupled wheels, 5 ft. 6 in. diam., the frames being inside throughout. The following is the list of these struggling heroes, who really deserved well of their

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Welsh country:—28, *Mazeppa;* 29, *Pegasus;* 30, *Albion;* 31, *Minerva;* 41, *Countess Vane;* 42, *Glandovey;* 43, *Plynlimon;* 44, *Rheidol;* 53, *Gladstone;* 54, *Palmerston;* 55, *Treflach;* 56, *Whittington.*

I may add that most of these passenger engines did not present very good examples of Welsh orthography, and no one would accuse *Mazeppa, Minerva,* and one or two others of much connection with the land whence came the "gentle shepherd." They were good little engines for their size, albeit the boiler pressure was only 120 lb. per square inch, and the total heating surface 915 sq. ft.

The above were not, however, the only tender engines used for passenger work. There was a class of six mixed traffic engines built in 1859-60 for the Llanidloes and Newtown and the Oswestry and Newtown Railways, also by Sharp, Stewart & Co. These had the leading and driving wheels coupled, 5 ft. diam. with 15½-in. (afterwards 16-in.) by 22-in. cylinders. Two of these had been sold, and the four remaining engines were as under:—5, *Montgomery;* 7, *Llanerchydol;* 8, *Leighton;* 9, *Volunteer.*

At one time some were generally used on the Llanidloes and Moat Lane Junction branch, which had to be provided with locomotive power in addition to the main lines. There were no representatives of this class on the Furness Railway, but the whole of the standard Cambrian main line 0-6-0 goods engines were of the same design as those of that railway, with 4 ft. 6 in. wheels and 16 by 24 in. cylinders. These engines during the summer months had to assist in passenger working, especially when piloting was necessary with the tourist trains. All were built between 1861 and 1878 by Sharp, Stewart & Co., and were known by the following names:—1, *Victoria;* 4, *Alexandra;* 6, *Marquis;* 10, *Marchioness;* 11, *Queen;* 12, *Prince of Wales;* 14, *Bronerion;* 15, *Glansevern;* *18, *Orleighton;* 19, *Hercules;* 20, *Vulcan;* 26, *Tubal Cain;* 27, *Cambria;* 34, *Cader Idris;* 35, *Castell Dendraeth;* 39, *Sir Watkin;* 40, *Cyfronydd;* 45, *Rhiewport;* 46, *Towyn;* 51, *Snowdon;* 52, *Harlech.*

* No. 18 engine had been the property of the Denbigh, Ruthin and Corwen Railway, and was handed to the Cambrian Railways by the London and North Western Railway in return for services rendered to the latter.

Of tank engines for local branch passenger traffic there were three of the 2-4-0

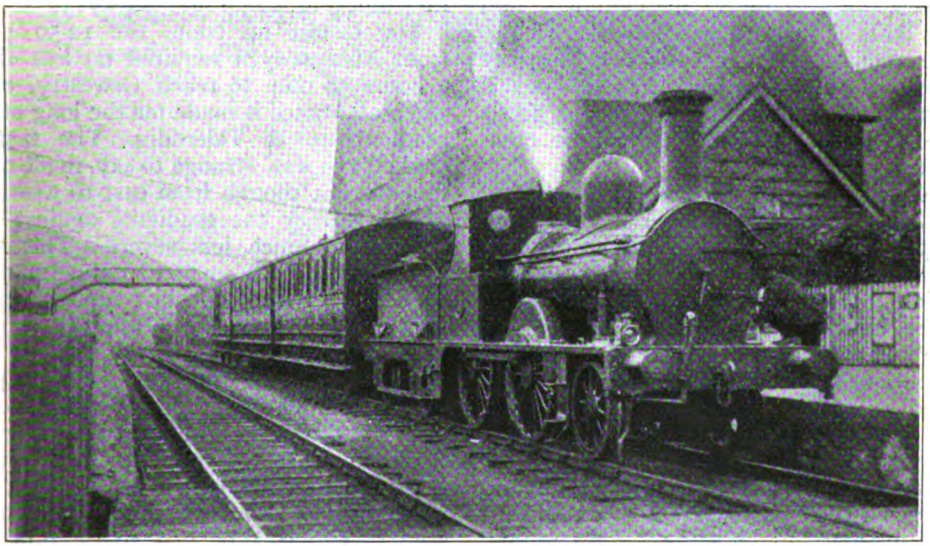

Photo.] [*K. A. C. R. Nunn.*

OLD 2-4-0 LOCOMOTIVE, No. 41, ON PWLLHELI TRAIN AT MACHYNLLETH.

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type built by Sharp, Stewart & Co. in 1866: Nos. 57, *Maglona;* 58, *Gladys*, and 59, *Seaham*. The coupled wheels were 4 ft. 6 in. diam. and the cylinders 14 by 20 in. There was also one 0-4-2 saddle tank, No. 3, *Milford*, built in 1859 for the Newtown and Llanidloes Railway with cylinders of the same size, but larger wheels 4 ft. 9 in. diam.

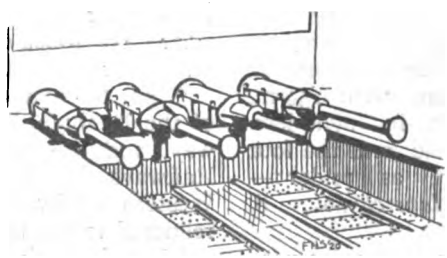
One more engine remains to be mentioned, No. 13, *Talerddig*, a six wheels coupled side tank banking engine, which for many years was employed in assisting trains up the Talerddig incline mentioned previously. This engine had 4 ft. 6 in. wheels, and 17 by 24 in. cylinders, and was built in 1875 by Sharp, Stewart & Co. The remaining engines of the company consisted of a number of miscellaneous small tank engines and a few odd goods tender engines which need not be mentioned.

A peculiar feature of the train working in 1880 was the large number of conditional stops. Thus between Whitchurch and Ellesmere there were six down trains, of which only one was booked to stop at the three intermediate stations. The other five trains were all scheduled to stop conditionally on giving notice to the guard or at the stations. Truly the guards and engine drivers must have been endowed with good memories. Many of the trains in both directions picked up and set down their passengers at stations west of Oswestry by the same "conditional" process. But plenty of time was allowed for it. The three fastest trains took 42, 45 and 50 min., respectively, for the 18¼ miles between Whitchurch and Oswestry, and there was no undue hurry, the trains ambling along in a sedate and decorous manner. The best down train left Oswestry at 5.57 p.m., and took 3 hours 28 min. for the 77½ miles to Aberystwyth, and the afternoon train at 2.25 p.m. was allowed 4 min. longer. An average journey speed inclusive of stops of 22¼ m.p.h. for the best tourist express could hardly be termed particularly exhilarating.

There were also the mail trains. The "down mail" was conveyed to Welshpool by the joint line from Shrewsbury, and was then handed over to the Cambrian. It arrived at Welshpool at 4.10 a.m. and left at 4.40 a.m., reaching Aberystwyth (61¾ miles) at 7.25 a.m.

The fastest up train, the 12.50 p.m. from Aberystwyth required no less than 3 hours 58 min. to reach Oswestry, even when allowance is made for the long steep gradient up to Talerddig. The fastest booked run was, strange to say, made over this summit though from east to west, on which journey the gradients against the train were much less severe. This was the 17¾ mile run from Moat Lane Junction to Cemmes Road, the last nine miles of which were down the Talerddig bank. This run, with two conditional stops, was performed at the rate of 26½ m.p.h. But even when the gradients were favourable the Cambrian did not unduly bestir itself. The next-best run was from Machynlleth to Borth, a distance of 12½ miles over a level or slightly downhill section, and was booked to be done in 30 min. at a running average of 24½ m.p.h. The Cambrian Railways in those days evidently relied upon scenery instead of speed, and gave the passengers plenty of time in which to take in its beauties.

(To be continued.)



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British Locomotive Practice and Performance.

By CECIL J. ALLEN, A.M.Inst.T., A.I.Loco.E.

Photo.] [*R. Murphy.*

GREAT SOUTHERN & WESTERN RAILWAY.

Down mail train running into Cove Station (Queenstown.)
4-6-0 four-cylinder locomotive, No. 401.

SOME notable accelerations of train services took effect on the West Coast railways in the early part of February last, and deserve passing mention in these columns. The most meritorious, in my judgment, are the substantial cuts in time on the Caledonian Railway, which in the majority of cases accelerate the running to the level of that which obtained immediately before the war. For instance, the 10 a.m. from Edinburgh once again makes the run of 100·6 miles over Cobbinshaw and Beattock summits to Carlisle in the very creditable time of two hours exactly, at an average speed of 50·3 m.p.h.; I may add that I have already made a successful trip on this speeded-up express, wherein non-superheated 4–4–0 No. 926 with a 225-ton train brought us down to Carlisle in 118¼ min., despite a gale from the south-west. The 49·7 miles from Beattock Summit to the stop occupied 48 min. 25 sec., and we came through from Symington in 69¼ min.; but of this journey more in a later issue. As in pre-war days, the Edinburgh train now carries its own Manchester and Liverpool portions through to Preston, stopping there specially to detach them, and running forward thence to Crewe to join there the 10 a.m. from Glasgow, which calls only at Motherwell (conditionally) and Carlisle.

Similarly the 10 a.m. *ex*-Euston now splits again at Crewe---this, incidentally, is the cause of the "paper" deceleration of the 10.20 a.m. down Liverpool, which, though still really reaching Crewe at 1.17 p.m., is shown as arriving at 1.21 p.m. in order to give no connection with the Edinburgh and Aberdeen portion of the "Scotsman"—the Glasgow section leading, and making Carlisle in 163 min., or 4 min. over the pre-war allowance, while the heavier second part has an allowance of 169 min. On the first day of the "speed-up" I was on the Glasgow train, and a 4–6–0 "Claughton" with 200 tons was doing 78 m.p.h. ten miles from the Crewe start, passed Warrington in 23 min. 50 sec. (24·1 miles); to cut a long story short, we reached Carlisle in 157¾ min., or 152 min. net, after a late start of 16¾ min. from Crewe. It was a novel and refreshing experience, after many weary years' interval, to cover the 31·5 miles from Carnforth up to Shap Summit in 39 min. 25 sec., with a clear "lift" of nearly 900 ft. *en route*, and to do the final "pitch" of 5·6 miles from Tebay in 8 min. 45 sec.;

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minima were a shade over 36 m.p.h. at Grayrigg and 31 m.p.h. just before Summit box, where the driver notched up prematurely, and we fell to 28. Similarly on the up journey, in continuation of my good run from Edinburgh, a "Prince" 4–6–0 with 250 tons brought us from Carlisle down to Preston in 110 min. 10 sec., despite four dead slows for adverse signals and the net time for the 90 miles cannot have been more than 100 min. We were actually doing 67 m.p.h. at Penrith, on the *up* road, passed Summit in 42 min. net, restrained downhill speed to a very moderate figure as far as Oxenholme, and wound up by running freely at 71½ m.p.h. on a little easier than level track in the neighbourhood of Garstang! But I dare not stop to dwell on these exhilarating feats, as so much of accelerated running on other railways is crying out for description.

Photo.] LONDON & NORTH WESTERN RAILWAY. [*W. H. C. Kelland.*

Up Manchester express passing Blisworth. 4-6-0 locomotive, No. 496, "Harlequin."

Strictly speaking, the 10 a.m. from Euston is due at Central Station, Glasgow, at 6.25 p.m., being booked non-stop from Carlisle, including the ascent of Beattock bank, save for a conditional halt at Motherwell, to correspond with that of the up morning express. This is 5 min. under the 8½ hours, and if any passenger were enterprising enough to attempt to catch the 1.20 out of Crewe off the 10.20 a.m. out of Euston, he would make Edinburgh in 8 hours 10 min. from London! The times of the 1.30 p.m. from Euston are unaltered from London to Crewe—they certainly could not bear curtailment with such a load as this—and are "eased" 4 min. between Crewe and Carlisle, in view of the addition of the London-Edinburgh and Plymouth-Glasgow portions. But the Caledonian Company, heavier load notwithstanding, has cut the Carlisle-Glasgow time by 9 min., to 2 hours 20 min. On the up morning journey pre-war arrangements have been reverted to, in that the Edinburgh and the North train carries Edinburgh-Manchester and Edinburgh-Liverpool portions through to Preston, calling only at Lancaster south of Carlisle; the Glasgow 1.30 p.m. also takes Liverpool and Manchester coaches through to Preston calling at Carstairs (to change engines, 2.15–2.20 p.m.), Carlisle and Penrith. The Edinburgh train makes a notable run over the 66·9 miles from Symington to Carlisle in 77 min., but the up "Postal" beats this by covering the same distance in 75 min., start-to-stop, average 53·5 m.p.h. Before the war the quickest time for the last-mentioned stretch was 73 min. The two portions of the 1.30 p.m. from Glasgow and Edinburgh are once again

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united at Preston and reach London at 10.30 p.m., the overall journey time being 15 min. in excess of that operating before the war.

Important changes are made in the night express arrangements, the 11 p.m. from Euston making a run of 175 min. to Crewe (within 4 min. of the pre-war best), and reaching Edinburgh at 8 a.m., while the 11.15 p.m. from Euston takes 9 hours also to Glasgow. The 7.30 p.m. Highland express from Euston is considerably expedited, especially over the Caledonian line, where the 117·8 miles' run from Carlisle to Stirling, including 2 min. at Beattock the 32·5 miles to passing Forfar in 34 min. from Perth, while the corresponding up express (3.25 p.m. from Aberdeen) does the same journey in 34 min. start-to-stop; two other up expresses make this run in 36 min. These are cheering bookings, reminiscent of the old-time "Caley."

Of purely London and North Western changes the chief is the new express reaching Euston at 12.10 p.m., which combines the 8 a.m. from Liverpool and a new train from Manchester at 8.10 a.m., and runs non-stop from Stafford to London in 2½ hours. The new service between London and the West Riding towns of

Photo.] MIDLAND RAILWAY. [*W. H. C. Kelland.*

Down express near Mill Hill. Three-cylinder compound 4-4-0 locomotive, No. 1008.

for the bank engine (3.6–3.8 a.m.), is brought down to 149 min. But the down "Postal" beats that by 6 min., despite an additional stop of 4 min. at Carstairs; the latter makes the run of 39·7 miles from Carlisle to Beattock in 44 min.—a fine time, considering the large proportion of the route that is uphill at 1 in 200—whereas the bulk of the principal trains take 46 min. Furthermore, the "Postal" finishes its northward dash by covering the 33 miles from Stirling over Gleneagles Summit to Perth in 39 min., and the 89·8 miles on to Aberdeen in 99 min.—only 1 and 2 min. respectively over the very fast pre-war figures. This train traverses Yorkshire introduces a number of non-stop runs between Stockport and Huddersfield, and one through from Huddersfield to Crewe, but nothing much in the way of speed, of course, over such a route. Various minor alterations have resulted in accelerations of certain high speed runs between Birmingham and Euston; the 5 p.m. from New Street makes Coventry, 18·9 miles, in 20 min., (in addition to the two existing 19 min. schedules), equals 56·7 m.p.h.; by leaving Rugby 2 min. later, the Coventry and Leamington up express of three coaches due in London at 11 a.m. completes the 82·6 miles in 88 min., which is the fastest start-to-stop

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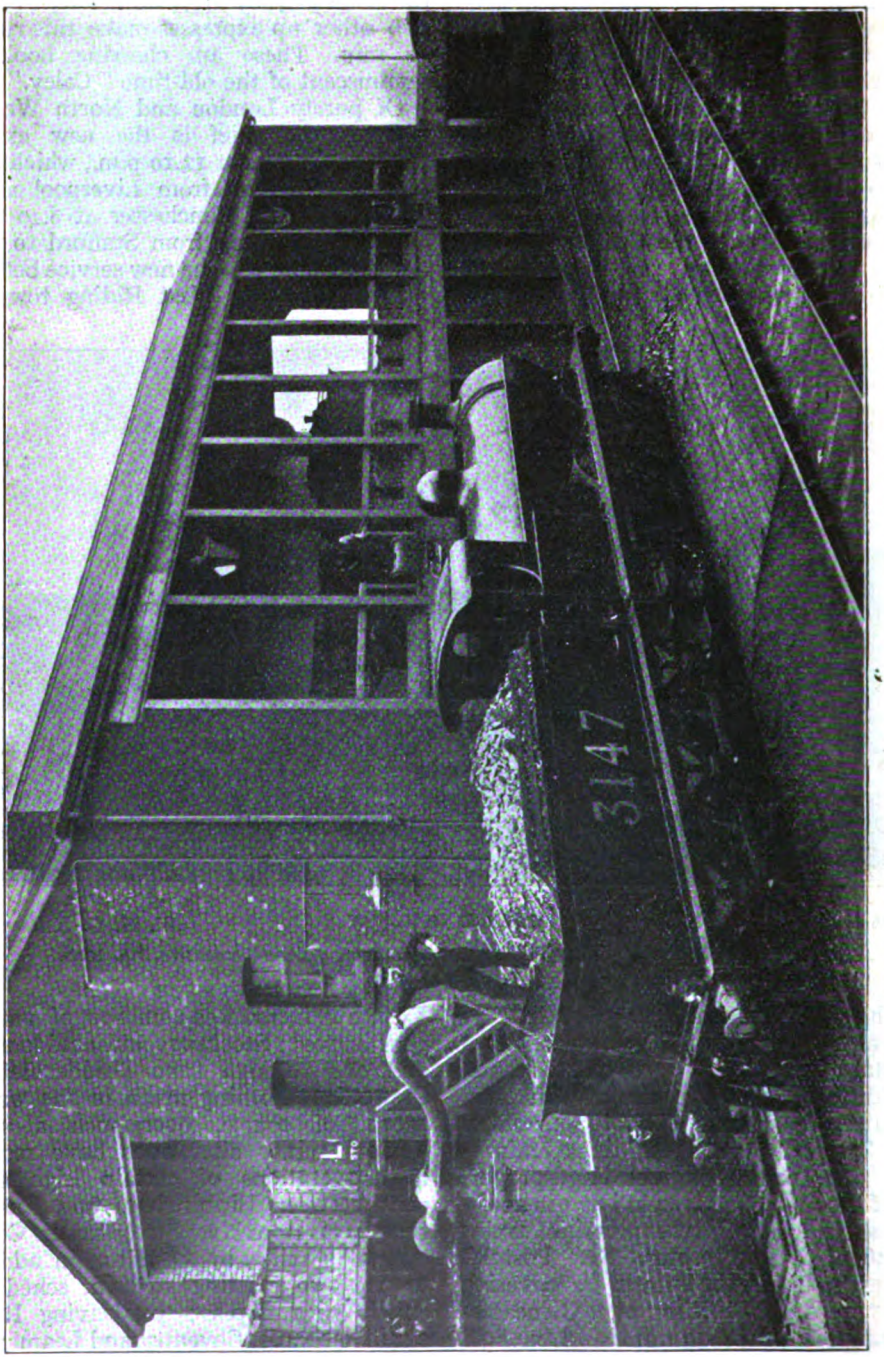

COAL STAGE AND LOCOMOTIVE TAKING WATER, MIDLAND RAILWAY.

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booking between these points that I can remember; and also, as previously mentioned, the 4.50 p.m. 2-hour Birmingham-Euston express incorporates in its schedule a stop at Willesden, covering the 107·5 miles in 109 min., at an average speed of 59·2 m.p.h.—exactly equal to the speed of the 11 a.m. 2-hour express from Paddington to Bristol.

A correspondent mentions details of a run with the 4.50 p.m. train, when 4–4–0 "George" No. 1730, *Snipe*, with a feather-weight five-coach load of 160 tons all told, passed Coventry, 18·9 miles, in 18 min. 50 sec., at 73 m.p.h.; Rugby, 30·3 miles, in 29 min. 25 sec.; Roade, 53 miles, in 53 min 5 sec; Bletchley, 66·2 miles, in 65 min. 40 sec.; Tring, 81·2 miles, in 80 min. 22 sec.; and Willesden was reached in 106 min. 28 sec. Thus the 107·5 miles were completed in a shade under "even time," at an average of 60·6 m.p.h.; after a stop of 50 sec., and a check over the widening works at Camden, Euston was reached in 119 min. from Birmingham. It will be seen that a commendably even speed was maintained throughout the journey; the last 4¼ miles up to Tring occupied 4 min. 25 sec., and the maximum subsequent downhill rate was only 66 m.p.h. But the load was very light.

There still continue to arrive queries in regard to the method given in my October article of last year, and explained further in that of February, in regard to the ascertainment of locomotive horse-power. "Re train resistance due to gravity," runs one letter, "I notice in the February issue that you work out the horse-power exerted by the engine of a 430-ton train by employing the figure 5·97, whereas the correspondent whose formula is given in your article for October says that 5·97 applies to a train of 200 tons, 8·96 to one of 300 tons, and so on proportionately. I should be very much obliged if you would kindly explain the discrepancy." The figures last mentioned were the working out of an equation previously given in respect of one specific bank—the 1 in 200 of Potter's Bar bank, G.N.R.—in which the constant "5·97," the gradient and the load had all been already taken into account, the only calculation remaining being to multiply 5·97, 8·96, 11·95 and so on into the speed in m.p.h., to ascertain the horse-power. The constant figure in the original equation is always 5·97, in all circumstances.

Another reader—a young friend whose discoveries have enlivened these columns on more than one previous occasion—as the result of his researches makes a most startling pronouncement. "I have calculated out the horse-power of a London and North Western 'Claughton' locomotive hauling 400 tons on the level at 68·2 m.p.h.," he tells me, "and make it 26,000. I therefore assume that one horse-power equals one pound of tractive effort." The horse-power figure reminds me of that memorable occasion when the journal with the daily record net sale gravely informed us that the Great Eastern "Decapod" would work at the staggering working steam pressure of 200 *tons* to the square inch. And the decisive assumption which follows stresses yet once more the perils of "a little learning."

The time has now come to describe, in the briefest way possible, the collection of runs over the Midland system that are reproduced in the accompanying tables. The route covered is between St. Pancras and Manchester; the runs in question, of which those north of Derby must be held over until a later issue, are, for the sake of brevity, a selection from a much larger number, both of my own and from correspondents, chosen in such a way as to exhibit as clearly as possible the variation in running showed by different classes of engine and different driving methods. Even allowing for the somewhat heavier loads of to-day, there is still an appreciable difference between Midland running at the present time and that of pre-war days. Piloting has been greatly reduced, and time-keeping, in consequence, has deteriorated, although in this respect the Midland can still show a superiority over a good many of its neighbours. One is inclined to wonder, indeed, whether the unique working methods of the Midland in regard to train-loads may not have the defects of their qualities, in that driving practice tends to become so absolutely standardised that drivers are not inclined to make any effort above the normal in coping with abnormal circumstances. Another peculiar feature that I have noticed, in the course of a number of journeys, is that certain drivers of compound engines are

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reverting to the practice of running almost or entirely without steam on down-grades, as they often did before the war, apparently forgetting that their uphill work still falls well behind pre-war standards; on several runs this has proved a source of lost time which can hardly be defended.

I had hoped, in answer to requests, to have found time to prepare a profile of the route for reproduction in the article, but this has been impossible, and I will therefore briefly recapitulate the gradients. Between London and Leicester the principal summits of a by no means easy main line are at 12¼ miles (Elstree); a sharply undulating tableland between posts 21 and 34; Sharnbrook Summit near mile post 59¾; At Desborough North Box (down side, 78½ miles); and at Kibworth North Box (down side, just beyond 89½ miles). To the first-named the line rises continuously at 1 in 162–182, save for undulations from 4½ to 7½ miles, which include 1¼ miles down at 1 in 196 from Cricklewood. From Elstree the line falls at 1 in 200 to Radlett, and undulates thence to 16½ miles, where begins the rise averaging 1 in 177 past St. Alban's to 21 miles. Of the subsequent undulations 1¾ and 1¼ miles down from the 25¼ and 28¼ mile-posts respectively are the steepest, both at about 1 in 200, and then from 34 to 49 miles comes that magnificent "racing ground" for down trains, nearly all at 1 in 200, except for a short break from 40 to 41¾ miles (Ampthill), where the grade eases, and there is a very brief piece against down trains. From 49 to 54¼ miles there are undulations, principally favourable to up trains, except the mile down, partly at 1 in 146, from Oakley station northward to the troughs; at 54¼ miles begins Sharnbrook bank, which is from 56¼ to 59⅝ miles exclusively at 1 in 119; timers should take the ¼-mile from 59¼ to 59½ for the lowest speed on the down journey, and 60 to 59¾ for that on the up, in no case forgetting to take the time of passing mile-post 59¾ (up side), which is reckoned as the summit.

From 59⅞ to 62½ miles the line falls at 1 in 120, and thence to 64 miles mainly

TABLE 1: MIDLAND RAILWAY—LONDON-LEICESTER.

Distance.	No. of Run: / Engine 4–4–0 No.: / Engine Class: / Load, Tons tare: / Load, Tons full:	Schedule.	1 / 562 / 2 S. / 193 / 205	2 / 767 / 3 S. / 208 / 225	3 / 1031 / 4 N.S. / 187 / 200	4 / 1033 / 4 N.S. / 187 / 200	5 / 1000 / 4 S. / 219 / 230	6 / 1008 / 4 S. / 229 / 245
Miles.		Min.	M. S.	M. S.	M. S.	M. S.	M. S.	M. S.
0.0	St. Pancras .. dep.	0	0 00	0 00	0 00	0 00	0 00	0 00
1.5	Kentish Town pass	4	5 08	4 35	4 00	4 15	4 05	3 50
3.5	Finchley Road ,,	—	8 50	8 02	6 45	7 20	7 15	6 55
6.9	Hendon .. ,,	10	13 45	12 25	11 00	11 50	11 55	11 30
12.4	Elstree .. ,,	—	20 24	18 42	17 50	18 25	18 35	18 00
15.2	Radlett .. ,,	—	23.13	21 26	20 50	21 15	21 30	20 55
19.9	St. Albans .. ,,	25	27 55	26 12	25 50	26 00	26 05	25 55
24.6	Harpenden .. ,,	—	33 45	31 28	31 50	31 25	31 15	31 30
30.2	Luton .. .. ,,	36	39 22	36 37	37 40	36 50	36 35	37 05
32.8	Leagrave .. ,,	—	41 53	38 54	40 30	39 25	39 00	39 30
37.3	Harlington .. ,,	—	45 57	42 55	45 05	43 25	42 55	43 35
41.8	Ampthill .. ,,	—	49 24	46 18	50 00	47 40	46 30	47 10
49.8	Bedford .. ,,	54	55 26	52 36	57 25	55 00	53 40	53 45
56.7	Sharnbrook .. ,,	—	61 43	59 18	64 25	61 55	60 35	60 15
59.7	Mile-post 59¾ ,,	65	66 04	63 42	69 10	66 15	64 40	64 25
65.0	Wellingborough ,,	70	70 55	68 32	74 20	71 15	69 30	69 25
72.0	Kettering .. ,,	77	78 00	75 55	82 05	78 10	76 30	76 35
78.5	Desborough N.Box,,	—	86 10	84 49	90 50	86 30	84 55	84 45
82.9	Mkt. Harborough ,,	90	90 39	89 22	95 20	90 55	89 45	89 00
86.3	E. Langton .. ,,	—	94 44	93 53	99 30	95 00	94 00	92 25
89.7	Kibworth N. Box ,,	—	98 35	97 52	103 20	98 45	98 15	96 10
95.4	Wigston .. ,,	—	104 05	103 25	108 45	104 15	104 15	101 40
99.1	Leicester .. ,,	109	108 48	108 15	113 15	108 35	109 05	106 35

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at 1 in 163, after which there are very slight undulations as far as 70 miles. From here there is an arduous ascent of 8½ miles, varying in inclination from 1 in 218 to 1 in 118 past Kettering to 74¾ miles, where there is a slight drop of ½-mile, and then steepening to 1 in 132–136 from 75½ miles to Desborough North Box. Four miles follow at 1 in 132–133 down, concluded by a slack at Market Harborough now observed with such severity as to constitute an addition of fully a minute to the running times of crack expresses as compared with pre-war practice. From 83 to 85¾ miles there are sharp undulations, after which comes Langton bank, mostly at 1 in 130–167, to Kibworth North Box, whence follows a smart fall to 93½ miles, beginning at about 1 in 159 and easing to 199 after Great Glen; the remainder of the journey to Leicester is on easily falling grades, with a slack for down trains over Wigston North Junction. Beyond the hints already given, timers should beware of missing Bedford station, as the main line passes independently to the west of the station itself; the latter is just on the north side of the overbridge at 49¾ miles.

And now for the runs in tables 1 and 2. The first two are the only ones in the tables that were timed by correspondents; the figures in the former were taken from a very carefully compiled and detailed record of a fine effort for a "Class 2" engine, after initial loss of time by fog, which cleared after Mill Hill. Allowance for engines of this type being 180 tons on the 109 min. schedule, there was an excess of 13 tons on this occasion. Minima at Elstree and mile post 21 were respectively 47 and 46 m.p.h., and maximum at Radlett 66½; but between posts 38 and 40 speed averaged 79·2 m.p.h., and between 44

TABLE 2.—MIDLAND RAILWAY—LEICESTER–LONDON.

Distance.	No. of run: / Engine 4-4-0 No: / Engine Class: / Load, Tons tare: / Load, Tons full:	Schedule.	7 / 548 / 2 S / 228 / 245	8 / 769 / 3 S / 203 / 215	9 / 760 / 3 S / 205 / 215	Schedule.	10 / 1038 / 4 NS / 211 / 230	11 / 1031 / 4 NS / 219 / 235	12 / 1035 / 4 NS / 241 / 255
Miles.		Min.	m. s.	m. s.	m. s.	Min.	m. s.	m. s.	m. s.
0.0	Leicester .. dep.	0	0 00	0 00	0 00	0	0 00	0 00	0 00
3.7	Wigston .. pass	—	7 00	6 35	6 50	—	6 45	6 35	7 35
9.4	Kibworth, N. ,, Box	—	14 30	13 50	14 35	—	14 00	14 05	14 40
16.2	Mkt.Harborough ,,	20	21 30	20 20	21 10	20	20 25	20 45	21 20
20.6	Desborough, N. ,, Box	—	28 10	27 35	27 50	—	27 05	28 45	28 35
27.1	Kettering .. ,,	32	34 35	33 45	33 45	32	33 25	35 05	34 50
34.1	Wellingborough ,,	38	40 50	39 20	39 05	38	39 25	42 05	41 35
39.4	Milepost 59¾ ,,	45	46 45	45 15	44 45	46	45 15	48 35	48 15
46.1	Oakley .. ,,	—	53 05	51 35	50 50	—	51 40	55 20	54 55
49.3	Bedford .. ,,	54	56 00	54 15	53 25	56	54 35	58 25	58 15
57.3	Ampthill .. ,,	—	64 45	63 15	61 50	—	63 20	67 05	66 40
61.8	Harlington ,,	—	70 00	68 45	67 40	—	68 45	72 30	71 55
66.3	Leagrave .. ,,	—	76 05	74 35	73 45	—	74 35	78 35	77 30
68.9	Luton .. ,,	76	79 05	77 15	76 25	79	77 15	81 15	80 05
74.5	Harpenden ,,	—	85 40	83 00	81 55	—	82 55	87 00	85 20
79.2	St. Alban's ,,	86	90 45	87 35	86 20	89	87 35	91 40	89 40
83 9	Radlett .. ,,	—	95 20	91 25	90 10	—	91 25	95 30	93 15
86.7	Elstree .. ,,	—	98 35	94 00	92 50	—	94 05	98 05	95 45
92.2	Hendon .. ,,	98	104 15	98 50	97 45 sigs.	101	99 05 sigs.	103 00	100 20
95 6	Finchley Rd. ,,	—	108 15	101 55 sigs.	101 30	—	103 30	106 10	103 30 sigs.
97.6	Kentish Town ,,	104	110 50	104 15	104 15	107	105 55	108 55	107 15
99.1	St. Pancras arr.	107	113 45	106 55	107 00	110	108 45	112 20	109 40
99.1	Net times .. min.	107	—	106¾	105¾	110	107	112¼	108½

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and 48, 81·8 m.p.h., with a "minimum" at Ampthill of 76. So the Luton-Bedford length was run in 4 sec. over 16 min. for the 19·6 miles. Sharnbrook bank was topped at 37½ m.p.h., and Desborough at 45, with a maximum of 75 at Irchester, and of 72 before Market Harborough; after the slack, Langton bank was commenced at 59 m.p.h., and completed at 46, and a final maximum of 69 beyond Great Glen brought the train into Leicester 12 sec. inside schedule; net time, allowing for the fog delay, I should estimate at 106½ to 107 min. C. W. Bailey, of Kentish Town, was the driver, and the effort was a commendable one. In the second log, which is one of the 2.25 p.m. down Manchester express, little detail is given as to speeds, and what is given is open to doubt, as the maximum shown between Harlington and Bedford is only 75 m.p.h., whereas the actual times were a shade faster to Ampthill, and nearly as fast on to Bedford, as the flying times of the preceding column. Minimum at Sharnbrook summit is recorded as 34 m.p.h., and at Desborough as 36 m.p.h., while maxima are mentioned of 79 an hour at Irchester and 70 at Great Glen. Times on this trip again were excellent for a "Class 3" engine hauling 3 tons over maximum load for this type.

In column 3 is shown one of the curious compound runs to which I have already referred. With a tare load 48 tons under maximum, No. 1031 made an undistinguished start, losing nearly 2 min. to Luton; steam was then shut off in descending from Toddington to Flitwick until speed had actually dropped to 53 m.p.h.! That is to say, with the train already behind time, nearly two more minutes were absolutely thrown away in this manner before we passed Bedford, while still more time was wasted by our "easing" through Wellingborough to 58 m.p.h. Consequently we dropped 4¼ min. to Leicester in a manner for which there could be no excuse. I have found this engine to specialise in this particular type of running; on another occasion we lost 2 min. in the same way on the same train (10.25 a.m. *ex*-St. Pancras), and there is an up journey tabulated which shows corresponding characteristics. Nos. 1035 and 1044, also with the same train and load, lost 2 min, and 1 min. in a precisely similar manner, the former easing badly north of Ampthill and to 46 m.p.h. (*sic*) at Wellingborough, while the latter did the same in a less marked degree, and added a slack of 30 m.p.h. at Harborough!

No. 1033 (column 4) gave a sound time-keeping trip, with no exceptional

Photo.] MIDLAND RAILWAY. [*F. E. Mackay.*

Double-headed 100-wagon train near Mill Hill. 4-4-0 locomotive No. 438 & 0-6-0 No. 3907.

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speed or exaggerated cautions; we touched 67 m.p.h. at Radlett, did not fall below 50 at St. Alban's, nor exceed 69 on either of the two stages of the descent to Bedford; minimum at Sharnbrook was 37½ m.p.h. and maximum at Irchester 70½; and the minima at Desborough and Kibworth were 43 and 43½ m.p.h. respectively. With a more substantial load, on the 9.50 a.m. down "Scotsman," Driver Kemp of Leeds gave a good exhibition with the superheated compound No. 1000; minimum rate at Elstree was 45 m.p.h., and at St. Alban's 50½ (fine work, this), with a maximum of 67 at Radlett; we passed Luton at 69 m.p.h., touched 79 and maximum at Irchester 70½; at Desborough we were doing 44½ m.p.h., and then, touching 70½ on the drop to Harborough (over which high speeds are never run), and taking Harborough station a little faster than usual, we commenced Langton bank at 64½ and finished it at 48 m.p.h., finally touching 66 m.p.h. before slowing at Wigston. But for the easy running north of Kibworth, we should have reached Leicester easily in the crack pre-war time of 106 min. with a load within 6 tons of the scheduled maximum. This time of 30 min. over the difficult 27·1 miles from Kettering to Leicester is the best I have noted for many years,

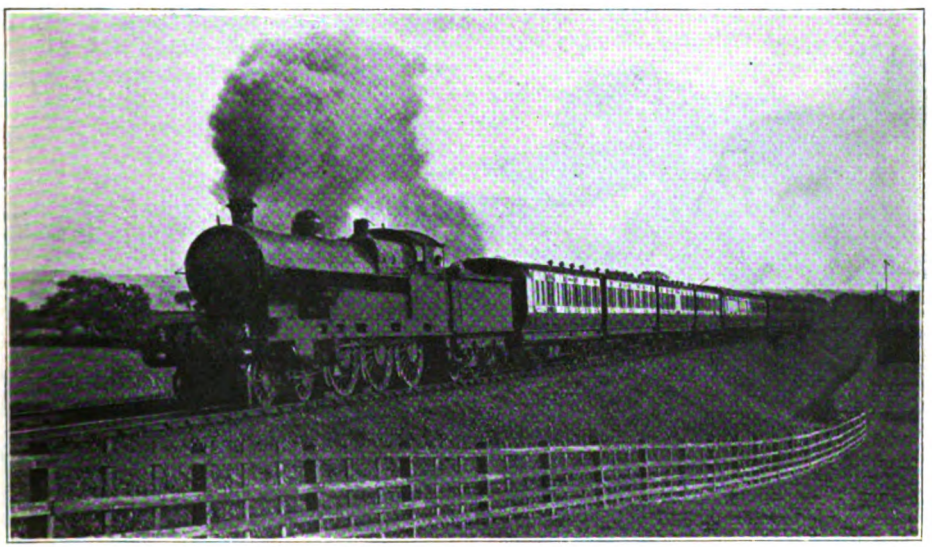

Photo.] LONDON & NORTH WESTERN RAILWAY. [*F. E. Mackay.*

Manchester–Lake District express. Four-cylinder 4-6-0 locomotive No. 1335.

before Flitwick but eased somewhat below Ampthill; Sharnbrook Summit was topped at 41 m.p.h., and we touched 75 at Irchester; and then, after clearing Desborough at 42½, Kemp eased the engine, as we were well on time.

Run No. 6 was made on the first day of the accelerations, and was a sterling trip behind that fine driver, Heseltine of Leeds, with another of the superheated compounds. We were doing 46 m.p.h. at Elstree and 67 at Radlett, but fell to 46½ at St. Alban's; Luton was passed at 66 m.p.h., and both stages of the descent to Bedford produced maxima of 79 m.p.h.; minimum at 59¾ miles was 39½ m.p.h. save for one recent trip on the 10.25 a.m. down, when "Class 2" rebuilt No. 494 and "Class 1," 2–4–0 No. 276 had the usual load of 200 tons, and dawdled so wretchedly over the early part of the journey as to be 3 min. "down" at Bedford. But they passed Kettering at 57½ m.p.h., only fell to 50½ at Desborough, had a maximum of 67 m.p.h. on the subsequent bank cut short by adverse signals, attained 60 m.p.h. beyond Harborough and 66 at Great Glen, with a minimum as high as 50 at Kibworth, and so ran from Kettering to Desborough North in 7 min. 10 sec., thence to Harborough in 4 min. 50 sec., (4¼ min. net), Harborough to Kibworth

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North in 7 min. 40 sec., and from there to Leicester in 10 min. 5 sec., total 29¾ min., or 29¼ min. net; thus we ran in exactly on time.

Table 2, in the up direction, now claims attention. The first run, numbered 7, is the one mentioned in the last issue, *apropos* of timekeeping. No. 548 was hauling over 25 per cent. in excess of the 180 tons maximum for engines of this type, and lost 6¾ min., although part of this—2 min. at least—may be attributed to fog at the London end. As far as Bedford, or even Luton, the work was good, but the engine seemed more or less "winded" within an ace of the "eighty" mark, but did not quite reach the magic figure), and Bedford was left behind at 71½ m.p.h. At Ampthill 44 m.p.h. was the minimum rate and at Toddington 44½; while at Radlett we reached 79 m.p.h.—for the third time on this journey—and at Hendon 76½, with a minimum of 56½ at Elstree. The signal check at Haverstock Hill was not severe, and so we just kept time.

No. 760's work in column 9 is, however, the finest of any, in my opinion, on the up journey. Driver Furnell, of Kentish Town, got some brilliant work out of the engine with exactly the maximum load,

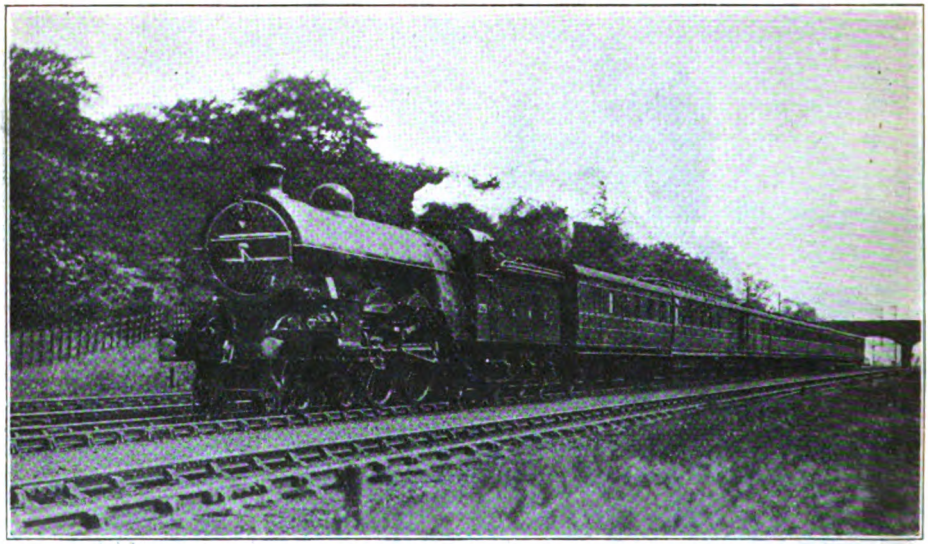

Photo.] GREAT NORTHERN RAILWAY. [*F. E Mackay.*

2.30 p.m. King's Cross—Hitchin train. Rebuilt 4-4-2 locomotive No. 279.

after this, and incapable of further exertion. No. 769 made a sound trip (column 8) with almost exactly "schedule" load (205 tons). Passing Kibworth North at 48 m.p.h., we touched 72½ at East Langton before slowing to 43 through Harborough—a check which, in its present severity, adds considerably to the difficulty of climbing up to Desborough. At the latter summit we were doing a shade under 36 m.p.h., but Kettering was passed at a level 79, and Wellingborough at 71½ m.p.h. At Sharnbrook Summit we had fallen to 37½ m.p.h., but Sharnbrook bank produced 79 again (it is curious, by the way, on what a large number of these journeys we got net time to London, by my reckoning, being 105¾ min. Touching 71½ m.p.h. before Harborough and slacking there to 44, we topped Desborough summit at 40 m.p.h. exactly—a fine achievement, this, up 1 in 132, the speed being, of course, sustained—and then got up to 80½ m.p.h. just beyond Kettering. At Finedon we were still doing 77½ m.p.h., and at Wellingborough 72½ m.p.h., the time of 5 min. 20 sec. from Kettering to Wellingborough being the fastest I have ever yet clocked—the *average* speed for the seven miles was thus 78·8 m.p.h. We were over Sharnbrook Summit at 41½ m.p.h., and touched 77½ before the troughs at Oakley, reaching

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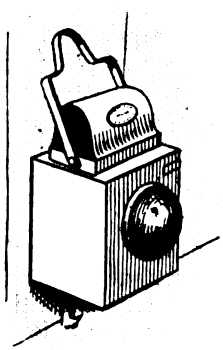
75 again at Bedford; thus the 22·2 miles from Kettering to Bedford were reeled off in 19 min. 40 sec. Somewhat easier work was performed up to Luton, with minima of 43½ m.p.h. at Ampthill and 44½ at Toddington; but we passed Luton at 65 m.p.h., touched 66 before Harpenden reached 77½ at Radlett and 76½ at Hendon, and should have gained over a minute on schedule but for the concluding delay.

We now come to the compound up journeys, in each case on one of the slightly easier-timed expresses. On the whole, the compounds do not show up so well here as the "Class 3" engines, whose work has certainly been revolutionised by the addition of superheating apparatus. No. 1038 ran well ahead of time all the way, keeping practically to the ordinary 107 min. sectional times. A top speed of 74 m.p.h. was reached at East Langton, and after slowing to 43 m.p.h. at Harborough, we maintained 40 m.p.h. to Desborough summit. We were eased severely through Kettering, to 67 m.p.h., but subsequently touched 72½ m.p.h., and went up to Sharnbrook summit again at a minimum of 40. Before Oakley troughs the maximum was 75 m.p.h., and the two stages of the ascent to Toddington were completed at minima of 45 and 45½ m.p.h. After this we reached maxima of 76½ and 75 m.p.h. at Radlett and Hendon respectively, and ran into St. Pancras in 1¼ min. under schedule allowance, despite the signal check.

No. 11 was another of 1031's erratic efforts; we slacked to 45 m.p.h. for Wigston Junction, passed Harborough funereally at 30 (although permitted to run here at 40 !), and slacked heavily for both Kettering and Wellingborough. After Bedford normal work was performed but no time was regained, and we were 2¼ min. late in. No. 1035 (column 8 made a peculiarly bad start to Wigston, and then, without any deliberate slowings, such as those last mentioned, by only moderate speed down the banks was as much behind time at Bedford as No. 1031. But then there was a fine recovery; we came out of Ampthill tunnel at a level 50 m.p.h., touched 56½ beyond Flitwick, and breasted Toddington at 47½; across the tableland to St. Alban's we maintained 60 to 67 m.p.h., and then rose rapidly to 80½ before Radlett; while the minimum at Elstree was exactly 60 and the maximum at Hendon 76½ m.p.h. We should certainly have covered the 49·7 miles from Bedford to St. Pancras in 50¼ min., but for the signal check at Haverstock Hill; as it was, we just kept time, and the net time from Leicester was 1½ min. less than that allowed, despite a load 16 tons in excess of the maximum scheduled.



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Railway Electrification in Chile.

SANTIAGO STATION, CHILEAN STATE RAILWAYS.

CHILE covers an area of nearly 290,000 square miles, and has a population of nearly 4,000,000, and the decision to electrify the steam railway system of the Republic renders it one of the largest undertakings of its class.

Chile is a long, narrow country located between the Andes Mountains and the Pacific Ocean, on the west coast of South America. It is 2,629 miles long north and south, or more than double the average length of the United States from Canada to Mexico, and varies from 100 to 250 miles in width. The extreme length of the country results in a variety of climatic conditions, but in the section first to be electrified the variation between maximum and minimum temperatures conforms to normal conditions existing in the temperate zones, the maximum temperature in the shade in the summer being from 100° to 110° F., and in the sun as high as 130° to 140° F., while in the winter the temperature goes as low as 20° to 25° F. The rainfall in this district is relatively small. In the central and southern sections the Andes receive a heavy snowfall, making extensive water power available.

The total railway mileage of Chile is 5,200, of which about 30 per cent. is privately owned, mainly for mining and industrial enterprises. The remainder of the mileage is divided into two general classes, broad gauge and narrow gauge. The former extend south from Valparaiso by way of Santiago to Paerto Montt, with numerous branches, while the latter comprise most of the northern roads with a few branch lines in the south.

The conditions that arose during the world war brought forcibly to the attention of the railway management the necessity for electrifying the broad gauge lines, especially the Valparaiso-Santiago line with the Los Andes branch, where traffic was rapidly approaching track capacity. In addition, fuel costs were excessive, while the almost limitless water power was going to waste.

In 1918 a Commission was appointed to study the problem of electrifying the broad gauge lines. This Commission, consisting of Rafel S. Edwards and Ricardo P. Solar, made a careful analysis of electrifications all over the world. As a result of the possible economies shown in the report of this Commission, it was decided immediately to electrify the broad gauge lines, beginning with the Valparaiso-Santiago and Los Andes branches, or the first zone. A loan of $10,500,000 for this purpose was authorised, and was heavily over-subscribed a few hours after offering.

The contract was awarded to the Westinghouse Company, whose engineers, in conjunction with those of the local firm, Errazuriz Simpson & Co., made an exhaustive study of every possible condition which would affect or be affected by the proposed electrification. The specifications called not only for locomotives to fit the traffic conditions, but also for all

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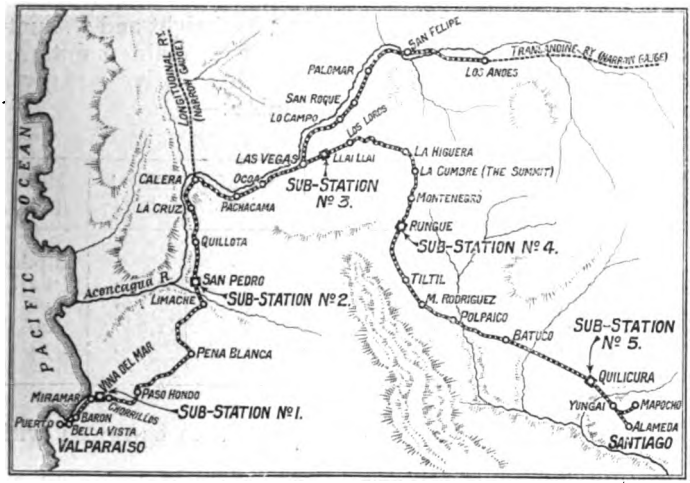


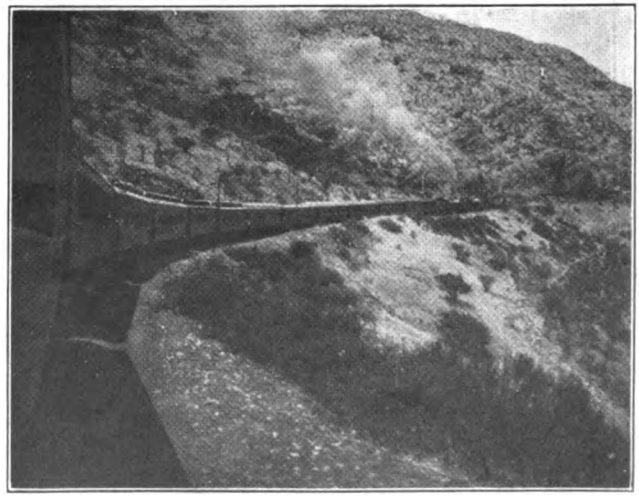
FIRST ZONE TO BE ELECTRIFIED.

sub-station, distribution and overhead equipment, and for all construction work; in other words, for the complete electrification of the railroad.

The initial electrification will include 116 miles from Valparaiso to Santiago, and 28 miles from Las Vegas to Los Andes. Los Andes is the terminus of the Transandine Railway, a narrow gauge line, while the narrow gauge longitudinal railroad runs north from Calera, an important station on the line to be electrified. The maximum grade in this zone is 2·25 per cent., encountered in approaching La Cumbre (the Summit) from the west. The line, which is on the 5 ft. 6 in. gauge, contains a relatively large number of curves, while there are six tunnels on the main line, the longest, the San Pedro, being 1,600 ft. in length. Three of the tunnels are located on the most severe grade approaching the Summit.

The 3,000-volt direct-current system was decided upon as best suited to the conditions. Hydro-electric power will be generated at the Maitines Station of the Chilean Electric Tramway & Light Company, Limited. This station is already under construction, and will utilise the waters of the Rio Colorado. The station will contain three 8,125-k.v.a. Westinghouse generators, and will have an ultimate capacity of 30,000 kw. This power will be transmitted 37 miles to Santiago by twin-circuit 110,000-volt transmission lines, and will be generated at 50 cycles, three-phase. These transmission lines will be connected at Santiago with the system fed by the Florida hydro-electric station and the Mapocho steam station, both of which were constructed some years ago by the Germans, and were designed for 50-cycle three-phase power. The total capacity of the three generating systems at present proposed will be, when completed, approximately 120,000 kw.

The power supply will be distributed by five sub-stations designed to handle a train movement that is approximately 50 per cent. greater than that existing in 1917, with a further provision for tripling the 1917 traffic demands, if necessary. Each station will initially contain two Westinghouse 2,000-kw. motor generator sets, each set consisting of a 2,800-h.p. driving motor and two 1,000-kw. 1,500-volt generators connected in series. These



A LONG PASSENGER TRAIN ON THE CHILEAN STATE RAILWAYS.

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sets will be designed to withstand a 200 per cent. overload for five minutes without injury, and as an additional safeguard the flash suppressor, which the Westinghouse Company has developed, will be included.

Sub-stations Nos. 1 and 5 will receive power at 12,000 volts, while Nos. 2, 3 and 4 will receive power at 44,000 volts. Transformers and switching equipment will be of the Westinghouse latest design, and the Westinghouse developed power indicating and limiting equipment will be installed.

Thirty-nine electric locomotives are required for the initial electrification, this number comprising 6 express passenger, 11 local passenger, 15 freight and 7 shunting locomotives. The main points of interest about these locomotives are given in the following table :—

Type.	Weight.	Length.	Wheel arrangement.	No. of motors.	Total h.p.	Max. speed.
	Tons.	Ft. in.				m.p.h.
Express passenger ..	127	58 6	2–6–0 0–6–2	6	2,250	62½
Local passenger ..	80	40 6	0–4–0 0–4–0	4	1,500	56
Freight	113	49 10	0–6–0 0–6–0	6	1,680	40
Shunting	65	40 0	0–4–0 0–4–0	4	480	34

All locomotives will be equipped with Westinghouse motors. The express passenger and freight locomotives will be equipped with the Westinghouse system of regenerative braking, with its most modern development. The service in which the local passenger locomotives will operate will not require or justify the regenerative braking feature. The fact that this contract includes only the first railroad zone indicates the magnitude of the electrification project which Chile has undertaken.

GOODS YARD AT SOUTHAMPTON WEST, LONDON AND SOUTH WESTERN RAILWAY.

Photo.] UP EXPRESS ON MAIN LINES IN CENTRE. [*G. Chalk.*

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ONE END LIFTED BY CRANE AND LEADING WAGON PLACED BENEATH.

Transporting Trees.

By S. T. JAMES.

FOR shipyards and collieries, and for other essential industries, as well as for many less essential trades, timber supplies are of paramount importance. The task of taking the rough, round timber across the country, is one of the most difficult feats of rail transport.

After they are cut down, the trees have their branches chopped off, and after a while the trunks are hauled to the railway station and laid in the goods yard as near as possible to the crane. Special wagons are required on which to load these trees, and are of three kinds: single bolsters or "Macaws," double bolsters or "Dulcets," and "Twins," or "Mites." These wagons are of different lengths and sizes, but all are built specially for carrying long pieces of rail or timber.

The trees rest on a wooden bolster, about a foot high, fixed across each truck. The man in charge of a gang of timber loaders must be possessed of sound judgment, as bad loading quickly brings disaster. He must also be able to tell what kinds of trees he has loaded, *i.e.*, whether they are oak, ash or elm. The question of the kind of wagons to be used and how many are necessary to carry the load is a matter on which he must exercise his judgment. The trees have to be safely secured so that they shall not fall out of position, yet they must not be so tightly secured as to make the load rigid, otherwise the wagons will be derailed at the first curve. They must be loaded so that the weight is evenly distributed, and not all resting on one wagon or on one part of the wagon. The kind of wagon used depends upon the length of the trees to be loaded.

A very nice sense of discrimination is necessary in a good timber loader. The number of trees making up a load depends entirely upon the size and shape; sometimes it takes three or four wagons to carry one tree, and often three to five are necessary to safely convey two trees. On the other hand, it is possible to put a score of trees of the long thin kind, such as larch poles, into one load.

When this is done, there is an additional danger for the loader to guard against, the danger of the trees "spreading" that is opening out fanwise at one end, so that some of them extend over the wagon sides

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and ends. When this occurs whilst the trees are in transit, something closely approaching a miracle is needed to save a nasty accident to the first passing train.

A special staff of men is employed by each railway company to travel to the different stations and load all trees to be transported over the line, as the loading is an operation requiring skilled and experienced labour. The men work in gangs of 2, 3 or 4, and each gang is in charge of an experienced and competent foreman.

Perhaps the most arduous part of the timber loaders' job, is dragging the trees under the crane—"Snigging," as it is sometimes called. Often, the trees have to be dragged as much as ten yards, and horses are not always available, so the men have to pull each tree across the ground with no aid but that afforded by the crane. Railway cranes are not built for dragging purposes, so the operation is not without risk, and even on the coldest day the men sweat profusely as they tug and pull and turn with all their strength.

Slowly, but surely, the tree will be dragged into position for lifting, and the next step is to load it on the wagons. Usually, these are already in position near the crane, and the trees are lifted on to them. Sometimes, however, a very heavy tree is raised from the railway line, and the wagons shunted underneath it to the correct position, when the tree is simply lowered until it rests in the proper position on the bolsters.

Lifting the trees, though done by crane power, is not at all a simple operation, for it is necessary that each should rise evenly, not with one end sagging below the other. So it often happens that a tree, after being raised, has to be lowered again and the crane chain adjusted to preserve a balance. Sometimes this happens repeatedly. Crane power problems and dangers are repeatedly met with. The average railway crane at a country station has a lifting capacity of not more than 5 tons. It is, of course, at country stations where trees have to be loaded; not at big towns! And they are usually hand cranes.

Often, the timber loaders have grounds for believing that the tree to be lifted weighs much more than 5 tons. When this happens, great caution is necessary; everyone must stand well clear. There are exciting moments as the tree swings gently in the air, slowly rising higher and higher. As the crane creaks and groans, the sweat falls from the brow of the workers. Fortunately, the cranes are built with a large safety margin. That is to say, those guaranteed to lift 5 tons will lift six or even seven. But there is always a risk in raising more than 5 tons, especially when the crane is antiquated or the parts worn.

On the whole, accidents are surprisingly few. The most common is caused by the crane-brake failing. When this happens, the tree comes down from aloft with a run, and the crane-handle whirls round furiously to the descent. The loaders are lucky if they are not either caught and smashed by the whirling handle, or crushed by the falling tree.

When at length resting on the wagons, it only remains to secure the trees and make them safe to travel. Generally, those loaded on less than three wagons are secured to every bolster by chains and stanchions. A stanchion is an upright iron bar, two or three feet long, fixed in every bolster. Loads on three wagons are secured by chains and stanchions to the first two, but the stanchions are taken out of the third, to which the tree is not in any way secured. Trees resting on four or more wagons are secured by chains and stanchions to the first two, but stanchions are taken away from the others, and the chains are only used loosely. But so much depends on the size, shape and rigidity of the trees, that considerable skill is necessary in securing them "Wisely, but not too well!"

Immediately the loading is pronounced complete, the Goods Agent should carefully examine the work. Then the guard of the train to which it is to be attached, must also make a careful examination, and the shunters at each stopping place must examine the chains and adjust any that have slipped. In attaching each load to the train which is to take it forward, care must be taken to see that the trees are put as near as possible to the end of the train, and the butts must be leading when the train moves. This has been found to be the safest way of transporting them without damage to other wagons or goods.

To determine the amount of carriage on a consignment it is, of course, necessary to obtain the weight, and charge at so much per ton. Now, it is obvious that there is not in existence a weighing machine large

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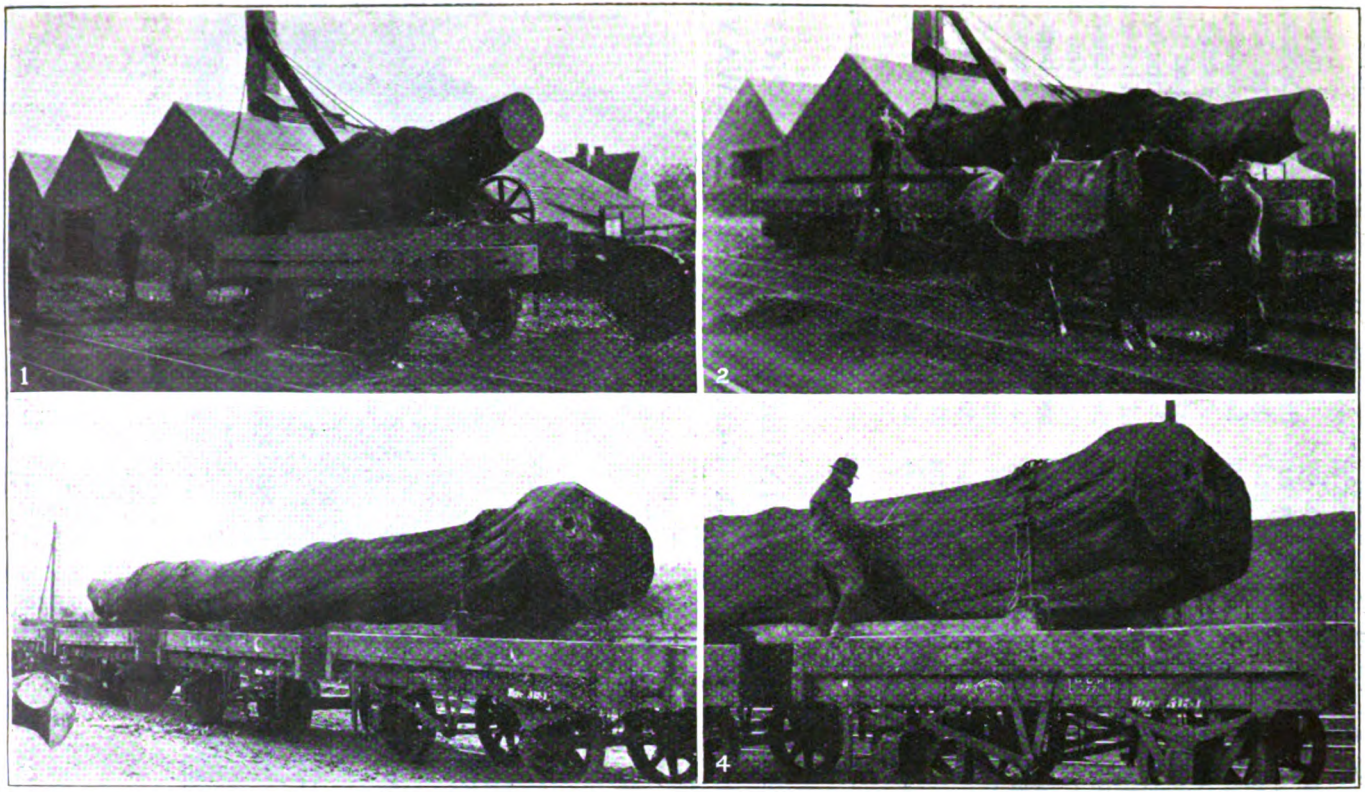

1. LIFTING ONE END TO PERMIT WAGONS TO BE BROUGHT INTO PLACE.
2. WAGONS DRAWN BENEATH POISED LOAD, WHICH IS THEN LOWERED UPON THEM.
3. LOAD IN PLACE, CHAINED AND SECURED, READY FOR TRANSIT.
4. MEASURING UP AN ASH TREE AT THE RATE OF 40 CUBIC FT. PER TON.

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enough to weigh the long trees, or if there is, it is not available. So it is necessary to arrive at some method of computing the weight. That adopted is for the cubical contents of each tree to be ascertained by measurement, and 50 cubic feet of elm, fir, pine, and the timbers classified, "Light" is calculated to equal 1 ton, as against 40 cubic feet of oak, ash, beech, and timber classified "Heavy."

It is not at all easy to measure a tree, for nearly all vary in size and shape, at different parts of the trunk, so that great skill and sound judgment are necessary if entirely wrong results are to be avoided. The girth of the tree is measured, also the length, and from the two the cubical contents of the tree are obtained by calculation. When the tree varies in size and shape, the measurer mentally divides it into parts, and measures, separately, each of different shape, when by adding the results, he arrives at the total cubical contents of the whole tree.

There are two methods of measuring: the "Tape over Bark, 144 Divisor," and the "Tape Under Bark, 113, Divisor." The latter gives the truer results, recording a greater weight than the former, from which it is easy to understand that the "Tape over Bark" method is the favourite of traders, who often insist on having their timber measured by it. The difference is apparent from the names. One set of measures is obtained over the bark of the trees, whilst the others are taken when the bark has been stripped off the girthing place. Usually, the computed weight arrived at is not much more than half the actual net weight!

4-6-2 VAUCLAIN 4-CYLINDER COMPOUND ENGINE, WESTERN AUSTRALIA GOVERNMENT RAILWAYS.

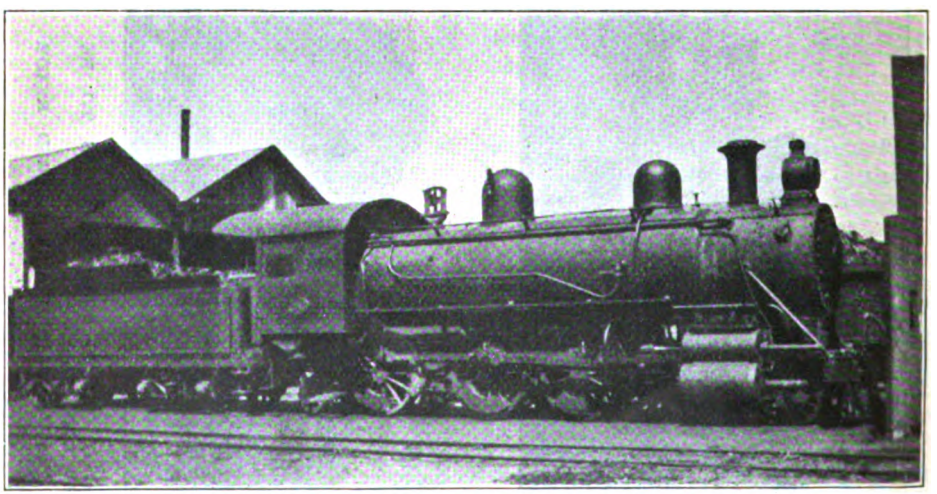

Photo.] [*E. W. Townsend.*

LOCOMOTIVES principally used for freight traffic are British built 4-8-0's and American 4-6-2's. One of the latter is illustrated. It is a Vauclain four-cylinder compound with superposed high and low pressure cylinders on each side. Cylinders are 12 and 20 in. diam, and 22 in. stroke; coupled wheels, 4 ft. 6 in. diam.; steam pressure, 200 lb. per sq. in.; and weight of engine and tender in working order, 73 tons. The gauge is 3 ft. 6 in.

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Railways in 1841.

By W. E. S. BROWN.

FROM a historical point of view the table reproduced on the next page is extremely interesting, showing, as it does, the position as regards traffic, capital, mileage, etc., of 33 of the principal railways in the United Kingdom existing 80 years since. Though self-explanatory, the following notes will serve as commentaries thereon.

It is remarkable that the then best paying branch of traffic was the passenger, precisely the one not counted on in prospective estimates of profit. Regarding goods traffic also, the estimates fell far short of the actual profits. As an instance thereof, the promoters of the Stockton and Darlington line only expected as the maximum export of coal from the Tees 10,000 tons per annum. But during 1835 no less than 704,781 tons were carried, and in 1839 this line and the Clarence transported 1,400,000 tons. Referring to the table, the weekly traffic on the 33 lines for September, 1841, was estimated thus: Number of passengers on 22 lines, 241,597, total therefore presumed at 400,000. Passenger receipts on 33 lines, £71,658 8s., and for goods on 25 lines, £16,845 9s. Totalised, this was an average of £73 10s. per mile per week. The traffic was thus at a rate of over three millions yearly, fifteen million passengers being carried to and fro. At the beginning of 1842 the total income of the English companies was put at £100,000 per week. There was, however, a loss side as well as a profit one, to this picture. Some lines, badly planned or placed, gave results quite the opposite of paying, and probably equally unforeseen. Others, in order to carry on, had greatly to increase their capital. A case in point was the Eastern Counties Railway. Projected in 1833, it was on July 4, 1836, that an Act was obtained authorising a line from Shoreditch through Ilford, Romford, Chelmsford, Colchester, and Norwich to Yarmouth. Originally the company's capital was £1,600,000, with power to raise by mortgages a further sum of £533,300. During the making of the line from London to Colchester, in 1840, the estimated cost of that part alone amounted to £2,173,143! The half-yearly report of the engineer, dated February 22, 1840, recorded an act of liberality in connection with the expense of this line, no less fine in itself than honourable to the individual concerned therein. This was the voluntary relinquishing of £15,000 due to the Right Hon. Henry Labouchere by the company for possession of a portion of his estate at Hylands, in Essex. On June 18, 1839, a portion of the line was opened from a temporary terminus at Devonshire Street, Mile End, to Romford, and on June 3, 1840, having reached its terminus in Shoreditch, it was further opened to Brentwood. The magnificent way in which our railways were first laid out, as it were, for all time, necessarily involved the outlay of tremendous sums of money on ways and works. As a specimen of the cost of a single item of the kind, take the splendid viaduct carrying the metals of the Manchester and Birmingham over the Mersey, and literally over the town of Stockport. A third of a mile long, with a 28-ft. wide roadway between parapets, it had 22 arches of 63 ft. span each, 4 of 20 ft., and two at each abutment. Its height from river-bed to rail-level was 106 ft., and 111 ft. to top of battlements, being 6 ft. higher than the famous Menai suspension bridge. In its building 400,000 cubic feet of stone, and over 11,000,000 bricks were used. The foundation-stone was laid on March 10, 1839, the work being finished on December 21, 1840. The cost was £70,000, saving £50,000 in the whole line to Manchester by increasing the altitude of this viaduct. The Stockport-Manchester section was opened on June 4, 1839. For mileage cost, it will be seen from the table, the London and Blackwall and London and Greenwich lines stand unrivalled. The former was projected in 1828, the Act being obtained in 1837. It was opened from Blackwall to a temporary station at Minories on July 4, 1840, and finally throughout on August 2, 1841. Its length was 3¾ miles, the gauge being 5 ft.,

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TABLE OF WEEKLY TRAFFIC & OTHER RETURNS

Capital and Loan	Amount Expended per last Report.	Cost per Mile	No. of Miles run per week	NAME. *No Sunday Trains. †No Goods Carried.	Week ending February	Passengers. Per Week	Passengers. Per Day	Receipts. Passengers, Parcels, Carriages, Horses, and Mails.	Receipts. Merchandise, Cattle, &c.	Receipts. Total.	Miles now Open	Traffic per Mile per Week	Miles Open in 1841	Traf. p. Mile p. Week, 1841.	Miles Open in 1840	Traf. p. Mile p. Week, 1840	When opened throughout.
£.	£.	£.			1341.			£. s. d.	£. s. d.	£. s. d.		£.		£.		£.	
1,056,666	1043,983	21,750	3,460	Birmingham and Derby Junction	19			728 12 0	176 9 4	905 1 4	48	19	38½	20	38½	18½	/839
1,266,666	1392,649	25,321	5,150	*Birmingham and Gloucester	18			1,238 9 7	193 3 7	1,431 13 2	55	26	52½	19½			/841
450,000	437,694	17,508	2,600	Brandling Junction						No Returns	25	31	21		15	32½	
496,999	456,631	30,442	1,770	Chester and Birkenhead						No Returns	15		15				/840
140,000	143,552	8,570	603	*Dundee & Arbroath	13	2,620½	374	144 17 5	60 10 0	205 7 5	16½	12½	16¾	10			
2,133,333	1888,242		1,960	†Eastern Counties	20	10,229	1,461	735 17 11		735 17 11	17½	42	17½	28	10½		
833,000	857,300	21,432	2,880	*Glasgow & Ayr						No Returns	40		40	17½	10½	5	/841
666,666	657,532	29,001	2,740	*Glasgow, Paisley, & Greenock	19	10,279	1,713	532 5 10	151 17 1	684 2 11	22½	30½	6¾	41½			/841
2,164,333	2273,354	21,859	11,120	Grand Jn. & Chester & Crewe	12			4621 14 1	1,861 19 11	6,483 14 0	103¼	54¼	103¼	62¼	97	69½	/838
1,000,000	997,148	22,159	2,790	Great North of England	19			639 7 6	465 13 0	1,105 0 6	45	24½	45		0		/841
5,750,000	5877,120	49,701	20,560	Great Western	20	21,380½	3,054	7601 3 4	1,977 6 9	9,578 10 1	118¼	57	92	56	30¼	72½	/841
533,383	575,451	18,563	1,984	Hull and Selby	19	3,038	434	401 3 7	425 4 0	826 7 7	31	26¼	31	16¼			/840
458,000	435,399	21,369	1,340	Lancaster and Preston Junction	19	1,871	267	355 13 0	42 18 6	398 11 6	20¼	19½	20¼	22			/840
1,673,000	1434,725	46,281	4,464	Liverpool and Manchester	18					3,856 15 8	31	124½	31	146½	31		/830
5,500,000	5832,254	51,842	16,360	London and Birmingham	19			9,764 4 11	2,975 13 6	12,739 18 5	112½	107	112¼	105	112½	98½	/839
1,000,000	983,464	262,257	2,690	†London and Blackwall	24	30,492	4356	581 12 6		581 12 6	3¼	155	3	130¾			/841
2,400,000	2269,359	48,284	3640 / 520	†London and Brighton	19	3,587	512	1,795 7 0		1,795 7 0	40¼	36	0¼		0		/841
				London Shoreham Branch	19	1,615	231	54 9 0	13 4 11	67 13 11	5½	12¼	5½	20¼			/840
708,000	631,614	60,156	1,180	†London and Croydon	22	5,133	733	308 13 2	23 7 9	332 0 11	10½	31½	10¾	43	10½	44	/839
1,000,000	934,774	249,272	2,960	†London and Greenwich	24	26,102	3,729	760 13 4		760 13 4	3¼	203	3¼	208	3¼	226	/839
2,260,000	2420,173	29,853	15,710	London and South Western	20			3363 0 9½	744 8 0	4107 8 9½	93	44½	43	39½	58	36	/841
646,600	670,000	67,000	1,380	Manchester, Bolton and Bury	17			329 5 5	206 18 9½	536 4 2½	10	53¼	10	53½			
2,800,000	1,376,245		830	†Manchester and Birmingham	21			336 11 7		336 11 7	5	67¼	5½	58½			
3,249,000	2728,270	54,565	9,870	Manchester and Leeds	19			1,960 7 10	1,999 2 7	3,959 10 5	51	77¾	48		13½	45	/841
1,533,000	1,524,781	26,751	4,560	Midland Counties	19	7,439	1,063	1,269 6 1	978 8 3½	2,247 14 4½	57½	39½	57½	30¼	15½	15	/840
750,000	966,941	16,049	3,730	Newcastle and Carlisle	19			379 8 4	897 17 9	1,277 6 1	60¼	21¼	60¼	23¾	60¼		
320,000	232,078	33,298	1,250	Newcastle and North Shields	17	12,091	1,727	285 8 2	30 9 10	315 18 0	7	45	7	42¼			
720,000	677,917	25,108	3,120	Northern and Eastern	20	5,498½	785	790 12 8		790 12 8	27	26½	19¼	18½			
3,000,000	3,064,033	42,118	7,566	North Midland	19			2,051 8 4¼	1,637 3 6	3688 11 10¼	72¼	51	72¼	34½			/840
578,000	582,724	25,309	2,508	North Union	18	2,711	387	627 5 3	273 8 2	900 13 5	22½	40	22¼	36			/838
260,000	335,826	17,222	1,170	Preston and Wyre	19	1,261	180	88 6 10	48 15 2	137 2 0	19½	7	19½	12½			/841
933,000	251,527		910	Sheffield and Manchester	21	7,522	1,075	216 14 7		216 14 7	7	31	0		0		
800,000	267,524	13,376	1,380	†Ulster	20	8,415	1,202	343 5 5		343 5 5	24	14¼	8	19½	8		
476,666	603,172	21,542	2,640	York and North Midland	19	5,600	800	924 13 3	438 2 3	1,362 15 6	28	48¼	24	40	14½	22½	/840

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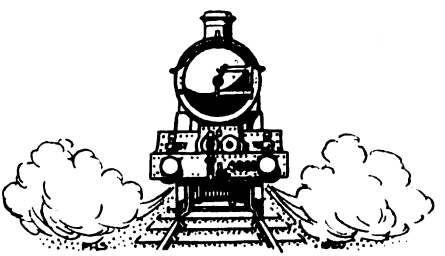
the same as that of the Eastern Counties, and the rails were 50 lb. per yard. The Birmingham and Derby Junction line was remarkable for its rapid execution. The Act secured in 1836, work began in 1837, and it was opened throughout on August 2, 1839. In this case the construction cost did not exceed the amount sanctioned. The Birmingham and Gloucester, opened from Cheltenham to Bromsgrove, a distance of 31 miles, on June 25, 1840, exceeded all expectations in its traffic returns, these being nearly double the estimate proved before Parliament. The Brandling Junction line (original share capital £250,000 in £50 shares) derived its title from the name of its projector, R. W. Brandling, Esq., of Low Gosforth, and was opened on September 5, 1839.

A line which cost nearly double its estimate to construct was the London and Birmingham. The Bill, introduced in February, 1832, was lost in the Lords in June following. Finally, sanction was obtained at a cost of £72,869. Works were begun in June, 1834, and completed on September 17, 1838. The Shoreham branch of the present London, Brighton and South Coast Railway was opened on May 26, 1840. For the purpose of laying their rails partly in its bed, the proprietors of the London and Croydon line purchased the Croydon-Deptford section of the Croydon canal at a cost of £40,200. Parliamentary sanction for making the London and South Western Railway was granted in 1834. It was opened to Woking Heath on May 21, 1838, and entirely on May 11, 1840, the Gosport branch being opened on February 7, 1842. Original capital, one million sterling, in £25 shares. The original capital of the Manchester and Leeds Company, the works of which were commenced in August, 1837, the Act being secured the previous year, consisted of 13,000 £100 shares. On this line, which was opened throughout on March 8, 1841, is the famous Summit Tunnel, 2,869 yards long, and a fine example of the engineering skill brought to bear on the making of our early railways. It was precisely a hundred years last year since the Bill for the construction of the Stockton and Darlington railway, after being twice rejected (application was first made to Parliament in 1818) was finally passed. The money for the making of this line, a sum of £125,900, was found by 60 shareholders, mostly members of the Society of Friends. The cost of carrying the permanent way of the Liverpool and Manchester line across Chat Moss, which presented the chief engineering difficulty, was £40,000. Although an eminent engineer opposing the scheme had observed that " no man in his senses would attempt a railroad over Chat Moss," George Stephenson thought otherwise. He drained the moss, threw up embankments, bedded the road with sand and gravel, laid on a platform of hurdles thickly interwoven with twisted heath, and carried the rails across it for four miles, the cost being the sum just mentioned.



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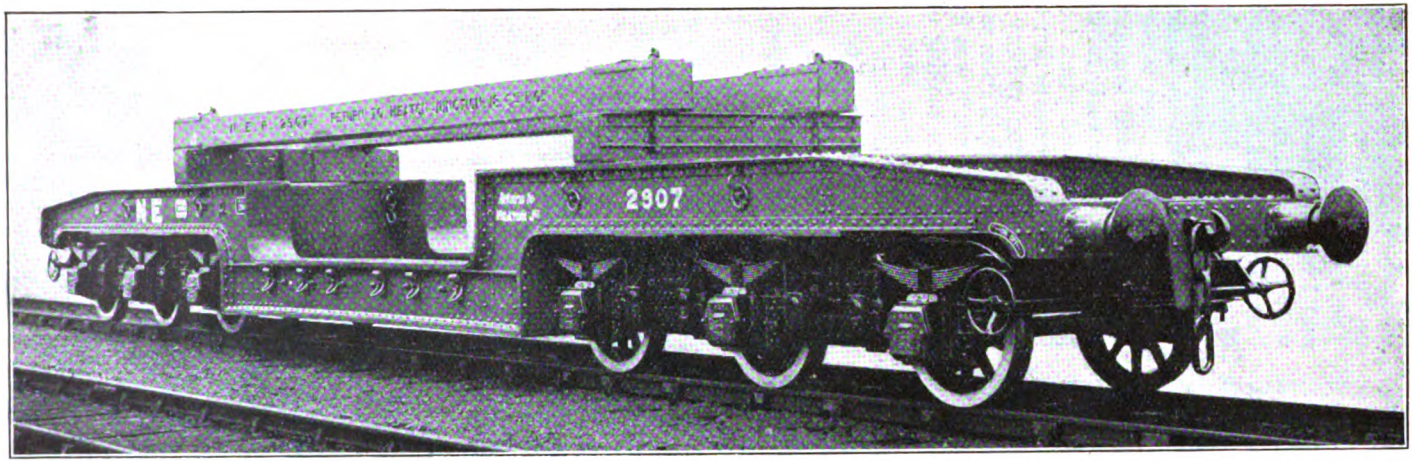
70-TON BOGIE TROLLEY WAGON, NORTH EASTERN RAILWAY.



BY courtesy of Sir Vincent L. Raven, K.B.E., Chief Mechanical Engineer, North Eastern Railway, we are enabled to illustrate and describe a 70-ton bogie trolley wagon recently built at York. Principal dimensions are: Length over buffers, 57 ft. 6 in.; length over headstocks, 54 ft. 6 in.; Length centre to centre of bogies, 35 ft. 6 in.; wheelbase of bogie, 12 ft.; tare weight of wagon, 38 tons 16 cwt. 3 qr.

Designed primarily for the conveyance of electrical stators for turbo-alternators from Tyneside, so that these can be sent erected complete with their turbines in position, it having been found unsatisfactory to ship the stators in parts and erect at site, the first employment of this wagon was the conveyance of an electrical stator from C. A. Parsons & Co., Limited, Heaton, for Shanghai, weighing about 60 tons, and representing the heaviest electrical stator in one piece which this firm have turned out, so there is ample margin in the design of the wagon for future developments.

Mounted on six-wheeled bogies having plate side frames, the wheels of the vehicle are 3 ft. 1 in. diam. on tread, having 12 in. by 6 in. diam. journals, 6 ft. 8 in. centre to centre, the whole of the bearing springs being fitted with equalising links.

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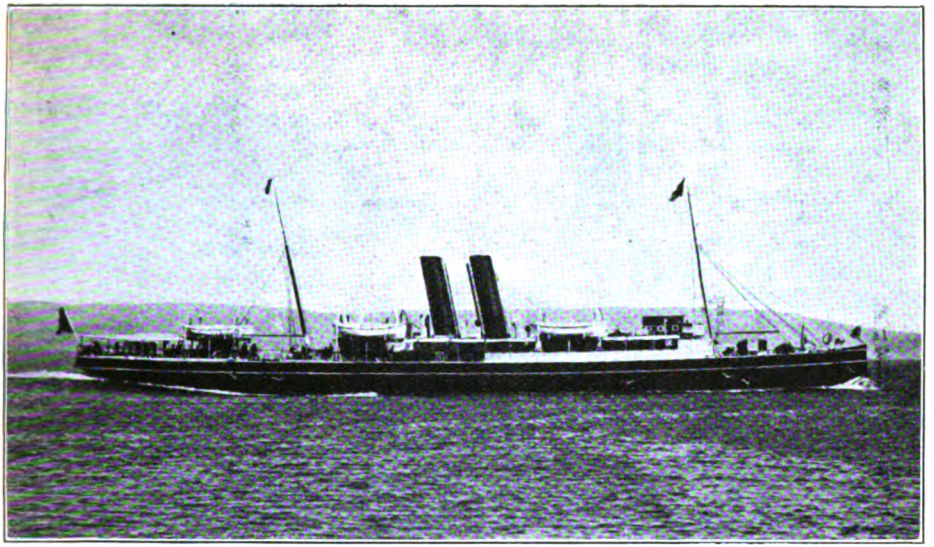

GREAT WESTERN RAILWAY STEAMSHIP "IBEX."

Great Western Railway and Channel Islands Traffic.

By W. TURNER PERKINS.

THE visit of King George and Queen Mary to the Channel Islands in July last has not only left among the population feelings of abiding gratitude and appreciation of the royal favour, but has actully done more than any event in recent history to establish a closer social and industrial relationship than has ever hitherto existed between Jersey and Guernsey. Future generations of the Islanders will, therefore, have cause to thank their Majesties for having been the means of inaugurating a better and a more sympathetic association, which may hereafter reveal itself in totally unexpected places. This was, indeed, exhibited in the overtures for a friendly exchange of courtesies that led to the official visit paid by His Excellency Major-General Sir John E. Capper, K.C.B., Lieutenant-Governor of Guernsey, on September 21 last, to His Excellency Sir William and Lady Douglas Smith in Government House, St. Helier, Jersey. As announced in the *Jersey Evening Press* and the *Guernsey Evening Press* at the time, the object of that visit was to enable the representatives of His Majesty to discuss various military matters relating to the Channel Islands, with a view to promote, or rather to cement, the good feeling which has always existed, and to further the interests and claims of both islands.

On that occasion, Sir John Capper, addressing his host, very truly said: "I have always felt that these two Islands have been too far apart in many ways. Both owe their inhabitants, their customs and their laws to the same source, and I think that anything that can be done to bring the Islands in closer concord should be helped by everybody."

It needed only the definite encouragement of King George to bring about, for the first time, such a happy reunion, and Colonel Clive Wigram, one of the Court equerries, by royal command, afterwards wrote to Sir William Smith stating that the King was much interested in his account of the visit of the Lieutenant-

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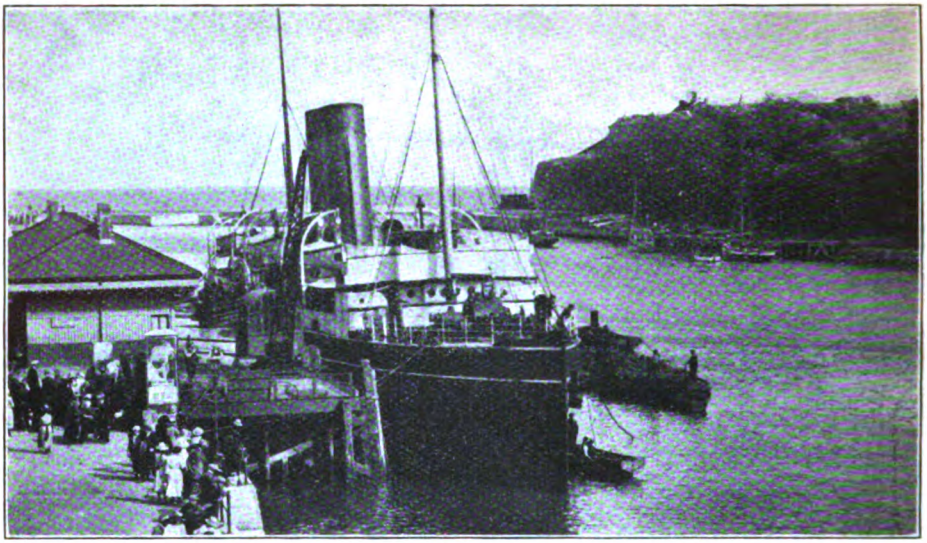

CHANNEL ISLANDS BOAT AT WEYMOUTH QUAY.

Governor of Guernsey, and to see the photographs which were taken on that occasion. The letter added: "His Majesty hopes that such meetings may be arranged from time to time, and feels sure that this personal and friendly contact between the Lieutenant-Governors of Jersey and Guernsey cannot fail to be attended with the happiest results."

It has already been decided that the Lieutenant-Governor of Jersey shall, during the present year, in Guernsey, officially return the welcome visit of his distinguished colleague, and all in the two islands share the view that "much good will result from such interchange of confidence, which constitutes quite a new departure."

Produce Exports from the Islands.—At one time Jersey exported virtually nothing except potatoes; but now tomatoes constitute almost as extensive a crop as potatoes. The growth of pears is another important feature. On the other hand, the cultivation of potatoes in Guernsey is quite a recent development. The latter island also successfully devotes attention more and more to the growth of tomatoes, grapes, peaches, figs and melons, leaving potatoes to fill a good secondary place in its general output.

The largest revenue of the year in Guernsey is derived from out-of-season produce—peas, beans, new potatoes and flowers—all grown under a system of intensive heat, first installed 35 years ago, and extended with amazing rapidity in the last quarter of a century. There are now no fewer than 2,000 growers, who have erected glass propagating houses, possessing a total lineal space of 150 miles. The Great War prevented further development upon a still larger scale; but when the cost of construction can be brought to a more normal basis, the same method of cultivation is certain to assume even greater proportions. It is true that some of the growers depend upon the sun's rays for the heat which is essential, but the artificial process is, as a rule, found to be the more profitable, and consequently that principle is now seen in flourishing operation upon all the larger estates in Guernsey.

Tomatoes represent three-fourths of the produce exported from that island, and for this branch of business nearly 3,000,000 baskets are in constant use from May to September. The output in 1921 far exceeded all previous records. Exact particulars are not yet complete, but we know definitely that in 1920 the total weight of tomatoes, grapes and melons and fruit shipped at St. Peter Port was 17,833 tons, as compared with 8,189 tons in 1900, which was the earliest year when exact particulars became available.

Various duties connected with tomato

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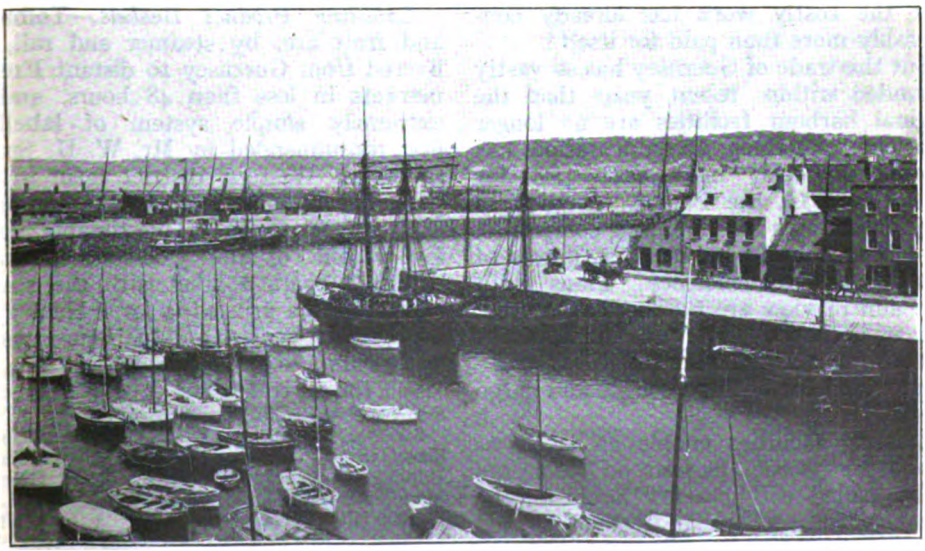
growing are uninterruptedly carried on for nine months in every year. The earnings of people engaged in this particular industry are consequently far beyond those of their neighbours, and it is no doubt chiefly on this account that the Guernsey States Parliament last year, for the first time in the Home Rule administration of the Island, called upon the inhabitants to pay income tax, at the rate of 6d. in the pound—an imposition which I am bound to state seems to have excited, among a contented and prosperous people, more mirth than surprise.

Some idea may be formed of the inherent productivity of the soil when it is remembered that in Guernsey the land is to-day worth not less than £350 per acre. Every square yard is eagerly and systematically cultivated, and it would be difficult to find a cottager who does not contribute to the total export of produce, while the holdings of the larger growers extend in many cases to 20 or 25 acres, with 14,000 or 15,000 lineal feet of propagating glass structures.

Jersey is kept very busy for two months in the spring with its crops of new potatoes, and later with two main crops of tomatoes, under which, as one gentleman told the writer, the island was in 1921 virtually "painted red." The tomato crop for last year was indeed the heaviest on record, and in the second week of September, the Great Western Railway Company's steamer *Pembroke* took away the largest cargo of fruit ever exported from the island, namely, 46,000 packages. The total weight of tomatoes exported in 1921 was no less than 22,199 tons. Detailed statistics for the year 1920 with which I have been favoured show that the total weight of imports was 95,299 tons, as compared with 76,406 tons in 1919, while the declared value of the same increased from £1,825,539 in 1919 to £2,871,261 in 1920.

Exports in the same year indicated equally remarkable progress, namely, from 54,443 tons in 1919 to 76,476 tons in 1920, the declared value rising from £1,809,033 in 1919 to £2,153,956 in 1920. In these figures the principal item was that of potatoes, which increased from 38,727 tons in 1919 to 61,296 tons in 1920, the total value in 1920 being £1,191,904, as compared with £377,259 13 years earlier, when the practice of keeping comparative records was instituted.

The Jersey potato season of 1921 was, however, the shortest on record—the aggregate value of the crops falling to £828,639—but as Mr. Charles H. Wilson points out in his useful annual analysis, the total export of potatoes then exceeded the abnormally light season of 1919 by 12,851 net tons, the acreage under



ST. HELIER HARBOUR, JERSEY

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ST. AUBINS, JERSEY.

such cultivation being in the later period considerably greater.

Harbour and Transport Facilities.—It was a resident of Guernsey (Jurat Henry Tupper) who suggested the construction of the harbour now existing in St. Peter Port. Many of Mr. Tupper's fellow-townsmen regarded the scheme as belonging to the "wild cat" class. The enterprise was, however, boldly undertaken, and completed upon lines which spelt success from the outset, with the result that the costly work has already considerably more than paid for itself!

But the trade of Guernsey has so vastly expanded within recent years that the original harbour facilities are no longer sufficient. Berthing accommodation has become obviously inadequate, and for some time past the Port Authorities, in conjunction with the shippping companies, have been considering the best means of remedying the deficiency. Plans with that aim in view are now well advanced, and it is hoped that additional berths and shore accommodation will shortly be provided for both passenger and cargo vessels.

Existing facilities enable as many as 20,000 to 30,000 baskets of tomatoes to be loaded within a few hours on the Great Western Company's cargo boats alone, and a scheme is in hand for further increasing the speed of handling. The work of shipment, while so rapid, is carried on so carefully that the claims for damage are virtually insignificant.

The harbour at St. Helier, Jersey, possesses a very large area, the total length of its quays being nearly six miles. While in Guernsey the quayside cranes are electrically operated, those at Jersey are steam driven. Electric current is shortly to be substituted there in the harbour machinery, and schemes to effect other improvements are under consideration.

Labelling Produce Baskets.—Tomatoes and fruit are, by steamer and rail, delivered from Guernsey to distant English markets in less than 48 hours, and an extremely simple system of labelling, first recommended by Mr. W. H. Smith, the Great Western district agent in that port, has been adopted by the company, and proved to be of inestimable value. Every one of the 3,000,000 packages exported bears a label with the station of destination printed in large black type. To the chief centres and markets a system of colours has been adopted. Thus, the labels for all traffic for

South Wales, Cardiff, Newport, Swansea, &c....	must be	Blue.
Scotch traffic	,,	Yellow.
Birmingham traffic	,,	Green.
Manchester traffic	,,	Red.
London (Covent Garden) ...	,,	White, type black.
London (Spitalfields)	,,	White, type red.

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Labels for other destinations are white, with print in bold block type.

Similar labels have for several years been in use in the Port of St. Helier; but while in Guernsey the States have made it compulsory that a grower shall label his baskets with the distinctive coloured labels mentioned, the authorities in Jersey have not yet taken corresponding action. Every effort is, however, being made to bring the exporters into line in this matter.

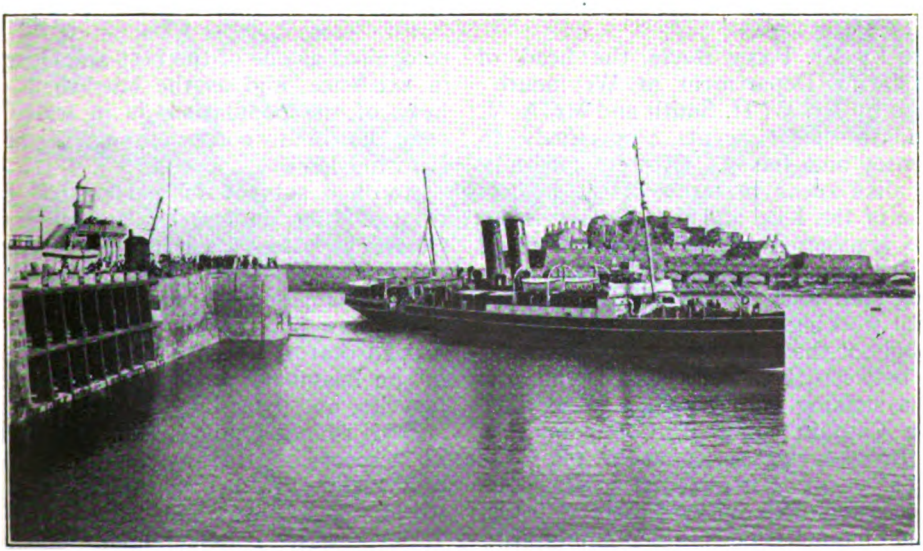
The Great Western Company's Passenger and Cargo Fleet.—Passenger and goods traffic to and from the Channel Islands has, in successive periods, led to the introduction by the Paddington board of larger and more powerful vessels, and, at no distant date, it may be deemed advisable to place upon the Weymouth—Guernsey—Jersey route steamships of even greater carrying capacity than the *Ibex* and *Reindeer*, principally employed for the passenger services. This step cannot be taken until the Island harbours have undergone enlargement sufficient to provide for such craft. But the Port authorities have, however, already decided to dredge and deepen many of the berths, thus to make necessary accommodation for such vessels.

A change of not less importance may likewise be witnessed in the complete separation of passengers and cargoes, by adoption of the principle of conversion so successfully introduced in the *Lynx* and the *Gazelle*, which were several years ago stripped of passenger fittings in order that the whole of their deck space and holds might be devoted exclusively to trade purposes.

Steaming under normal conditions at 16 knots, the handy *Gazelle*, built in 1889, is now the fastest cargo carrier afloat, and, in view of the constant progress recorded in both branches of the Great Western Company's traffic, it is possible that the directors may similarly adapt one or more of the steamships which have hitherto carried both passengers and produce across the Channel.

The *Ibex* (Captain C. Langdon), built in 1891, by Messrs. Laird, has been in continual service for 31 years, and her speed to-day is as good as ever. In the Great War she was the only Channel Islands vessel which earned the coveted distinction of sinking a German submarine. This was accomplished by a single shot fired from a gun at her stern, and, in recognition of the fact an award of £500 was made to Captain Langdon and the crew under his command. Justifiably proud of the achievement, the directors have had placed at the top of the saloon staircase a brass tablet, bearing the record:

> "During the Great War, 1914–1919, this vessel maintained the Great Western Company's Passenger and Mail Service between Weymouth and the Channel Islands, and on three



ARRIVAL OF A GREAT WESTERN RAILWAY STEAMER AT GUERNSEY.

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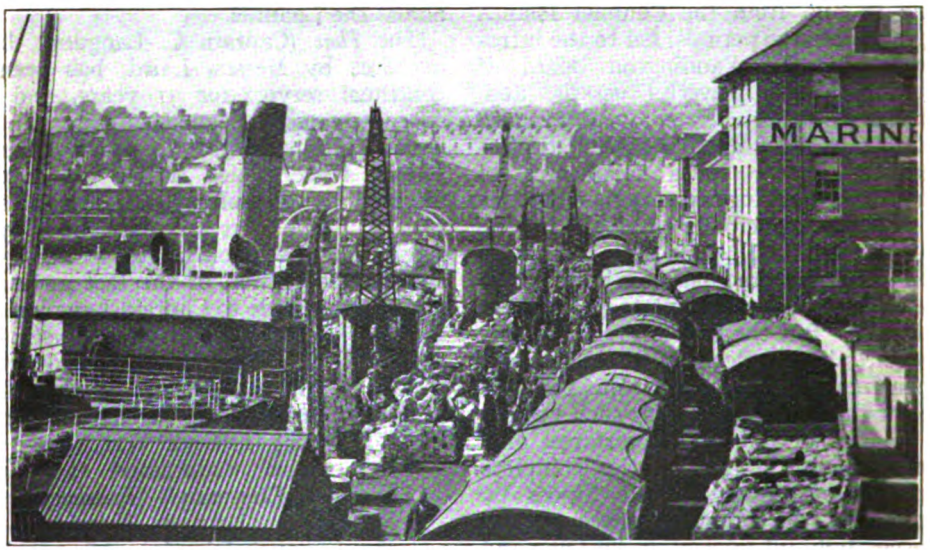
occasions was attacked by enemy submarines, one of which she sank by gun fire. The Government requisitioned the steamer at various times for the conveyance of troops to France."

Reindeer was similarly employed in the Mediterranean throughout the war, but had not an opportunity of meeting the enemy.

The Great Western Company is admirably served in the three ports engaged in this ever-expanding Channel Islands traffic by Mr. Percy Boyle, the head of the Marine Department at Weymouth; as also by Mr. W. H. Smith and Mr. A. V. Nash, the local agents respectively in Guernsey and Jersey. Growers and shippers alike speak in terms of the highest praise of the long and devoted service of these gentlemen. Acknowledgments are similarly expressed in regard to the navigating staff and all concerned with them in the working of the steamships, which throughout the year maintain communication between the Islands and Weymouth; and a striking tribute was paid to them when Captain Mullhall, Commander of the *Reindeer* was selected to pilot the King's yacht *Victoria and Albert*, on the occasion of the visit of their Majesties to the Channel Islands in September last.

Insular Characteristics. — Long ago Guernsey and her small neighbour Sark, the "gem" of the island group, were brought into direct telephonic communication, to the mutual advantage of their inhabitants generally. But shortsighted jealousies—which the visit of their Majesties last year may, it is hoped, for ever dispel—have up till now deprived Guernsey and Jersey of equally desirable facilities. This misfortune is all the more regrettable, in view of the fact that, to the lasting credit of Guernsey, the telephone system there in operation is officially recognised as one of the best and cheapest in existence, and as the one which, per head of the population, is in wider use than that in any corresponding area of the British Isles.



UNLOADING TOMATOES FROM THE CHANNEL ISLANDS AT WEYMOUTH QUAY.

Another subject of pardonable local pride is that, judged by the same test, Guernsey possesses a larger proportion of motor cars than any other centre in the United Kingdom, namely about one for every five persons. I am officially informed that at the present time there are in the Island 668 motor cars, 551 motor bicycles, and 7,724 bicycles..

Both islands enjoy enviable distinction in respect of their cattle, which are universally regarded as the finest in the world. Last year the price paid for Jerseys was, I understand, much in excess of that given for Guernseys, the

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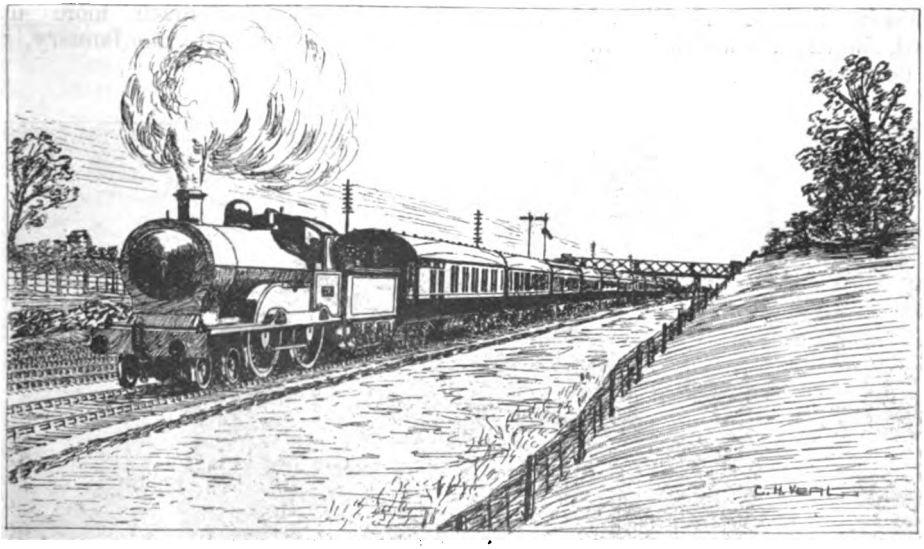
total value of 1,124 of the former exported from St. Helier being £54,476. Large herds of beautiful cows may often be seen on the pier at St. Peter Port awaiting shipment to America, which is the principal market for the breed, their milk being accounted second to none. No admixture of the stock from outside sources is sanctioned, and the most rigorous precautions against the outbreak of disease are adopted.

As health resorts—during spring, summer and autumn especially—Guernsey and Jersey are year by year advancing in public estimation. Their natural features vary of course considerably, but both are equally attractive. By virtue of its sunshine, Jersey stands pre-eminent among the holiday places of the United Kingdom, its mean total in 12 months, as recorded by the Jordan heliograph during 22 years, being 2,057 hours. In the same period Guernsey stood second, with 1,876 hours, while next in order were Worthing, with 1,875 hours, and Brighton with 1,790 hours. From 1899 to 1906 Jersey enjoyed an average of 2,012 hours of sunshine, for each year, or five and-a-half hours per day—a truly remarkable record.

The prevailing conditions of life in the Islands indicate general comfort, and, to say the least, modest affluence. In the technical sense, there are no poor, and should a newcomer be discovered who cannot support himself ashore, the steamship company which has brought him to the island is held responsible not only for his upkeep during his stay, but also for his free passage back to the original port of embarkation!

DOWN WEST COAST EXPRESS, LONDON & NORTH WESTERN RAILWAY.



4-4-0 LOCOMOTIVE, No. 882, "CANADA." [*From a drawing by C. H. Veal.*

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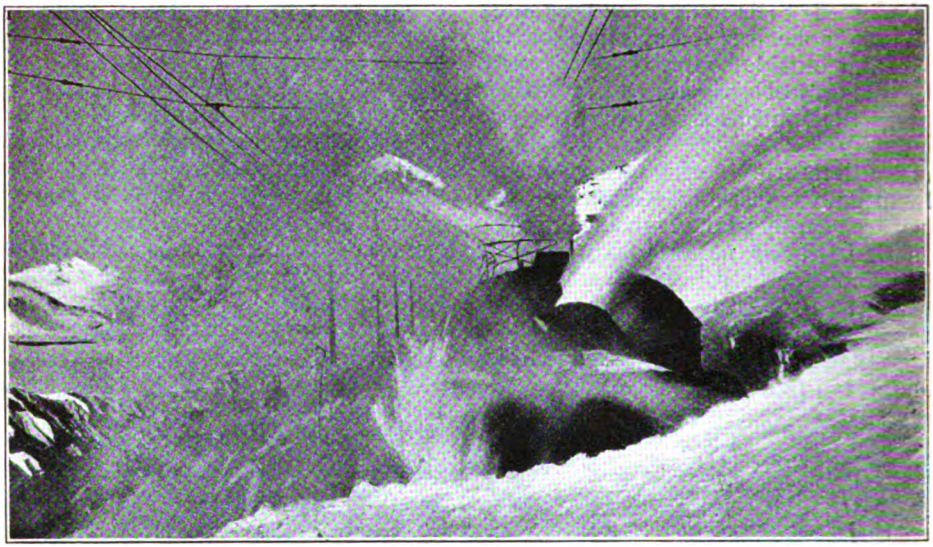
SNOW PLOUGHS ON A SWISS ELECTRIC RAILWAY.



APROPOS of references to snow difficulties on the Highland Railway, as set forth in Mr. Ahrons' recent articles, Major Lindsell sends from St. Moritz, Switzerland, the views reproduced, showing snow-fighting methods on the Bernina narrow-gauge electric railway.

It may be pointed out that Mr. Ahrons described conditions on Scottish railways as they were in the latter part of the nineteenth century. Methods are now much more up-to-date, as described in the January, 1921, RAILWAY MAGAZINE.

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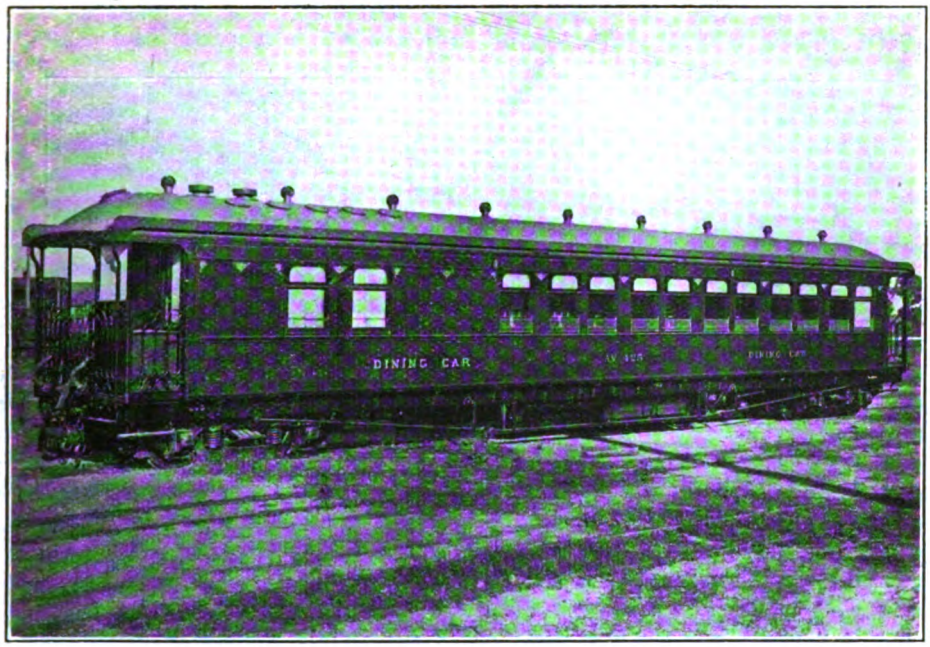

DINING CAR AS USED FOR TRANS-AUSTRALIAN TRAINS.

The Trans-Australian Railway.

THIS railway, opened in 1917, provides a valuable link between the east and western sides of the Australian continent, which hitherto were separated by a waterless and practically impassable desert. In addition the railway is assisting development in some of the districts through which it passes, and already the value of the land bordering the line has risen, and several large areas suitable for stock-raising purposes have changed hands at high figures.

The railway extends some 1,051 miles from Port Augusta, South Australia, which connects with Adelaide, Melbourne, &c., to Kalgoorlie, Western Australia, 375 miles from Perth. Unfortunately, in a journey across the continent from Adelaide to Perth, there are several breaks of gauge, thus :—Adelaide to Port Augusta, 5 ft. 3 in. and 3 ft. 6 in. ; from thence to Kalgoorlie, 4 ft. 8½ in. ; then 3 ft. 6 in. again to Perth. This is a serious drawback to the economic handling of passengers and goods, the latter undergoing costly transhipment.

One of the main problems during the construction of the railway and afterwards for its maintenance, was the supply of water for the staff, animals and locomotives. The average rainfall seldom exceeds 10 in. per annum, and, when it falls, soaks straight into the ground without a running stream. Water in the early days of construction was secured by boring and in most cases was salt, requiring to be condensed. This entailed bringing fuel hundreds of miles for the purpose. Subsequent exploration, however, found sites more or less suitable for the storage, by dams and reservoirs, of water which is of better quality, although unfit for human consumption.

The line at each end passes through hilly districts involving considerable earth work in its construction. The crossing of the Nullabor Plain was easier, requiring only the clearing away of scrub, and allowed the line to run straight for 300 miles—

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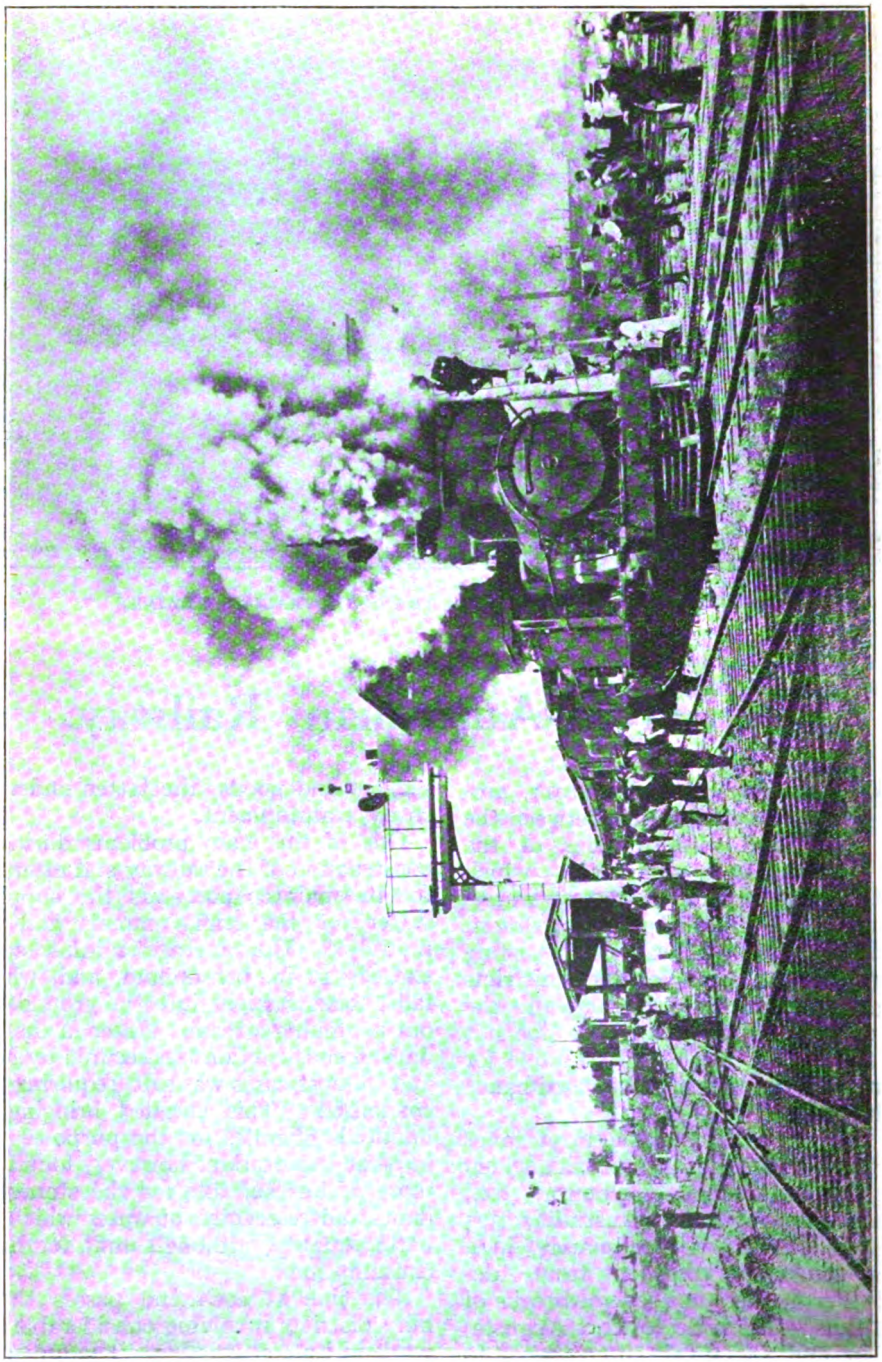

FIRST TRAIN FOR PORT AUGUSTA LEAVING KALGOORLIE, OCTOBER 25, 1917.

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probably a world's record. Materials, food and water were transported beyond the railhead by camels and horses.

As the line progressed, depôts were established at intervals, sometimes on wheels, and moving camps were provided ahead of the line for the earthworks gang. Platelaying was carried on direct from the wagons, and a track layer was utilised.

Track maintenance is carried out by gangs located at intervals along the line and where stations have been erected. Motor gang cars are largely employed. Telephonic communications can be made at any point *via* the overhead lines by means of portable tele phone sets.

Special rolling-stock has been constructed to work on the Trans-Australian service. This consists of first and second-class corridor sleeping cars, dining cars and brake vans. The bodies are built of Australian timbers, as are also the underframes of the first and second-class cars but the underframes of the dining cars and brake vans are of steel of the usual construction. The first and second-class cars are 61 ft. 8 in. over buffers and 59 ft. over headstocks. The bogie centres are placed 41 ft. apart and the bogies are of four-wheel type with a wheelbase of 6 ft. 3 in. The extreme width of body outside measures 8 ft. 9¾ in.

First-class cars have sleeping accommodation for 20 passengers or seating for 33 day passengers, and have four 4-berth and two 2-berth compartments, the latter being placed in the centre. The upholstering is carried out in green buffalo hide, and the fittings electro-plated.

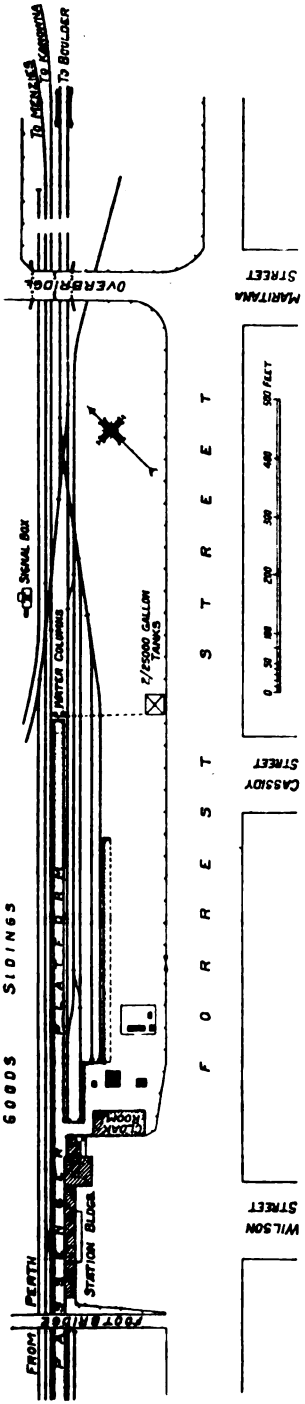

FIG. 1.—TRACK LAY-OUT, KALGOORLIE STATION. 3-ft. 6-in. GAUGE.

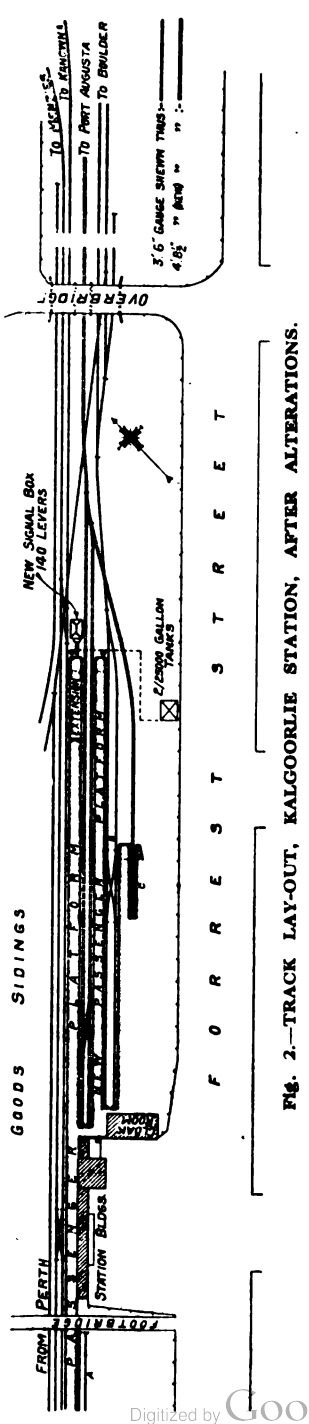

Fig. 2.—TRACK LAY-OUT, KALGOORLIE STATION, AFTER ALTERATIONS.

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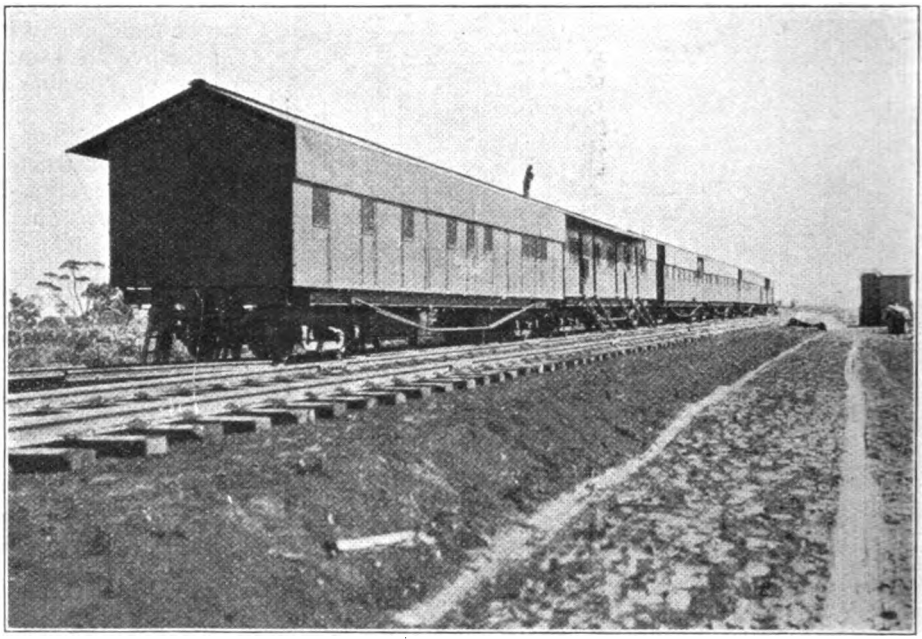
Second-class cars have sleeping accommodation for 36 passengers or seating for 48 day passengers, six 6-berth compartments upholstered in maroon leather cloth, and, as in the first-class, the fittings are plated. Both classes have a lavatory for gentlemen at one end and a ladies' lavatory and dressing-room at the other.

Dining cars are 60 ft. 9 in. long over buffers, 58 ft. over headstocks, the bogies being 45 ft. centres, the wheelbase 6 ft. 3 in., and the outside width 8 ft. 9¾ in. as in the cars. The interior is divided up thus :—Entrance lobby, 4 ft. ⅛ in. ; dining compartment, 24 ft. 11 in. ; buffet, 6 ft. 2 in. ; and kitchen, 16 ft. 6⅛ in. The dining compartment has a seating accommodation for 24 diners. The kitchen is equipped with cooking range, carving table, plate rack, meat safe, cupboards, &c.

Brake vans are 51 ft. 3 in. long over buffers, 49 ft. 2 in. over headstocks, 38 ft. 6 in. centres of bogies, the extreme width of bodies being 8 ft. 9 in. These vans have a 9-ft. guard's compartment with luggage compartments 22 ft. 5¼ in. and 16 ft. 11¼ in. on either side, and are equipped with a stove, desk and dog box. Their carrying capacity is 9 tons. The whole of this stock is fitted with electric lighting and vacuum brake apparatus, and the brake vans have hand brakes in addition to the vacuum. Trains are generally made up of three first-class, one dining, three second-class cars and one brake van.

Public traffic was inaugurated on the Trans-Australian Railway between Port Augusta, South Australia, and Kalgoorlie, Western Australia, in October, 1917. The latter station was adopted, after protracted negotiations between the Federal and the State authorities, as the point where break of gauge connection should be made between the Trans-Australian and the Western Australian Government railways. The special work involved in junctioning the Trans-Australian Railway (4 ft. 8½ in.) with the Western Australian Government railways (3 ft. 6 in. gauge), carried out by the latter department, can be best described by reference to the diagrams on the previous page.



CAMP TRAIN HOUSING OFFICIAL STAFF AT RAILHEAD DURING CONSTRUCTION.

In Fig. 1 will be seen a portion of Kalgoorlie station and yard, as existing prior to the construction of the Trans-Australian Railway. Its passenger facilities consisted of the usual station buildings, and one single platform long enough on its

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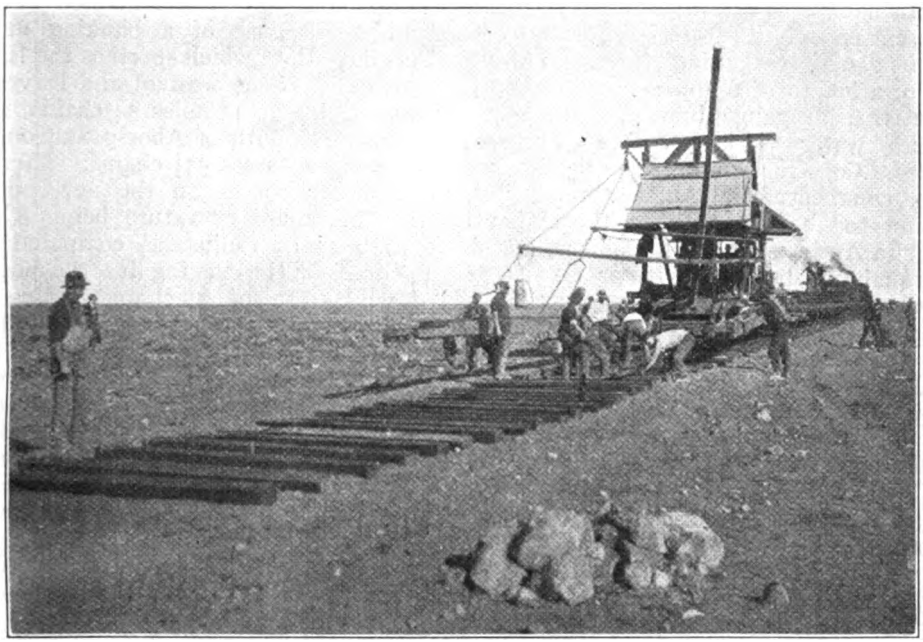
"through" side to accommodate both arriving and departing trains, with one dock on the eastern side for branch line traffic eastwards, the corresponding western dock being generally used for main line departing trains.

To meet the new traffic this platform was extended to a length of 1,520 ft., the extension being on the eastern end (see Fig. 2). The 3 ft. 6 in. gauge line was kept on the north side of this platform, while the Trans-Australian 4 ft. 8½ in. gauge line was constructed on the south side.

and departure, were constructed south of this platform, with a siding of 4 ft. 8½ in. gauge still further south, terminating in a dock for cattle and horse traffic. Spacious cloak room accommodation is also provided to facilitate the disposal of luggage where any waiting for connecting trains is incurred.

The eastern approach to the station is crossed by a road bridge, and this involved the complete remodelling of this structure, which required to be raised, strengthened and one new span added.



TRACK-LAYER AT WORK, CROSSING THE NULLABOR PLAIN.

This enables the transfer of passengers and luggage to be effected very expeditiously across the 20-ft. platform intervening. Alongside, to the south, a second 4 ft. 8½ in. line was constructed, and also a new platform some 800 ft. long, to serve this line and the new local traffic lines. These platforms are covered with simple umbrella roofs to protect from the weather. The local traffic branch lines, both arrival

A signal-box of modern design serving both gauges, and equipped with 140 levers, provides the necessary control for signals and points. Water is obtained from the Goldfields Water Supply. The station is lighted by electricity obtained from the municipality. The cost of the whole work, including the construction and alteration of tracks, overbridges, signal appliances, &c., was approximately £25,300.

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Engineering Improvements on the Gold Coast Government Railways.

THE Gold Coast Government system of railways consists of a 3 ft. 6 in. gauge line from Seccondee to Coomassie, a distance of 167 miles, with branches from Tarquah to Prestea, from Akyem to Insuta, and the Seccondee water works line from Inchaban Junction to Inchaban. There is also a section, at present entirely separate, also on the 3 ft. 6 in. gauge, extending from Accra to Tafo, a length of 65 miles, together with a 2 ft. 6 in. gauge branch, serving the Accra water works, to Weshiang, 10 miles. Construction of the original line was commenced in August, 1898, but, owing to the outbreak of the Ashanti War in April, 1900, the line did not reach Tarquah until May, 1901, or Coomassie until September, 1903. Construction is in progress from both ends on a line to extend the Accra-Tafo Railway to Coomassie, where the two at present independent sections will be brought into connection.

For engineering purposes the Seccondee-Coomassie line is sub-divided into the following sections :—(1) Seccondee (headquarters) to 36 miles, including the Inchaban and Insuta branches ; (2) 36 miles to 68 miles, with the Prestea branch ; (3) 68 miles to 168 miles (Coomassie). Each section is normally in charge of an assistant engineer with headquarters at Seccondee, Tarquah and Obuasi. These sections are divided into sub-sections varying in lengths from 30 to 45 miles, and supervised by foremen platelayers working directly under them.

In order to facilitate traffic working, particularly by the elimination of some of the sharpest curves and the easing of certain severe gradients, realignment or deviation works are in progress at several places. The first step taken in this direction was the putting in hand in July, 1919, of the Abosso deviation, which cuts out the two banks on the existing line known as the Adjah Bippo bank (from 45⅜ to 46⅜ miles) and the Cinnamon Bippo bank (from 47½ to 48½ miles), the gradients of these banks being 1 in 46, necessitating either a reduction of train load or the use of a banking engine. This deviation, which shortens the line by 870 ft., is to the west of and leaves the existing line at 43 miles 54 chains, about half a mile south of Abosso Station, and rejoins at 48 miles 53½ chains. There are only eight curves on the new portion, their minimum curvature being 8 deg., or 716·25 ft. radius, as compared with 44 curves on the existing line, the majority of which are of 5 chains radius and almost continuous between 45½ and 48½ miles.

A new station has been erected at Abosso, at the south end of the deviation, close to the junction with the existing main line. The new building is of concrete, roofed with corrugated asbestos sheeting, and provides the following accommodation: Stationmaster's office, telegraph office, with battery room and store adjoining. booking office, waiting hall, goods and parcels office and baggage room, with a verandah along the front and back of building.

Clearing work has also been put in hand on deviation No. 6 (9 miles 40 chains to 10 miles 21 chains) ; deviation No. 7 (10 miles 66 chains to 12 miles 48 chains) ; deviation No. 8 (12 miles 50 chains to 13 miles 67½ chains). The Insuta branch line has recently been completed. The construction of a deep water harbour at Takoradi, 5 miles south-west from Seccondee, is likely to be undertaken in the near future.

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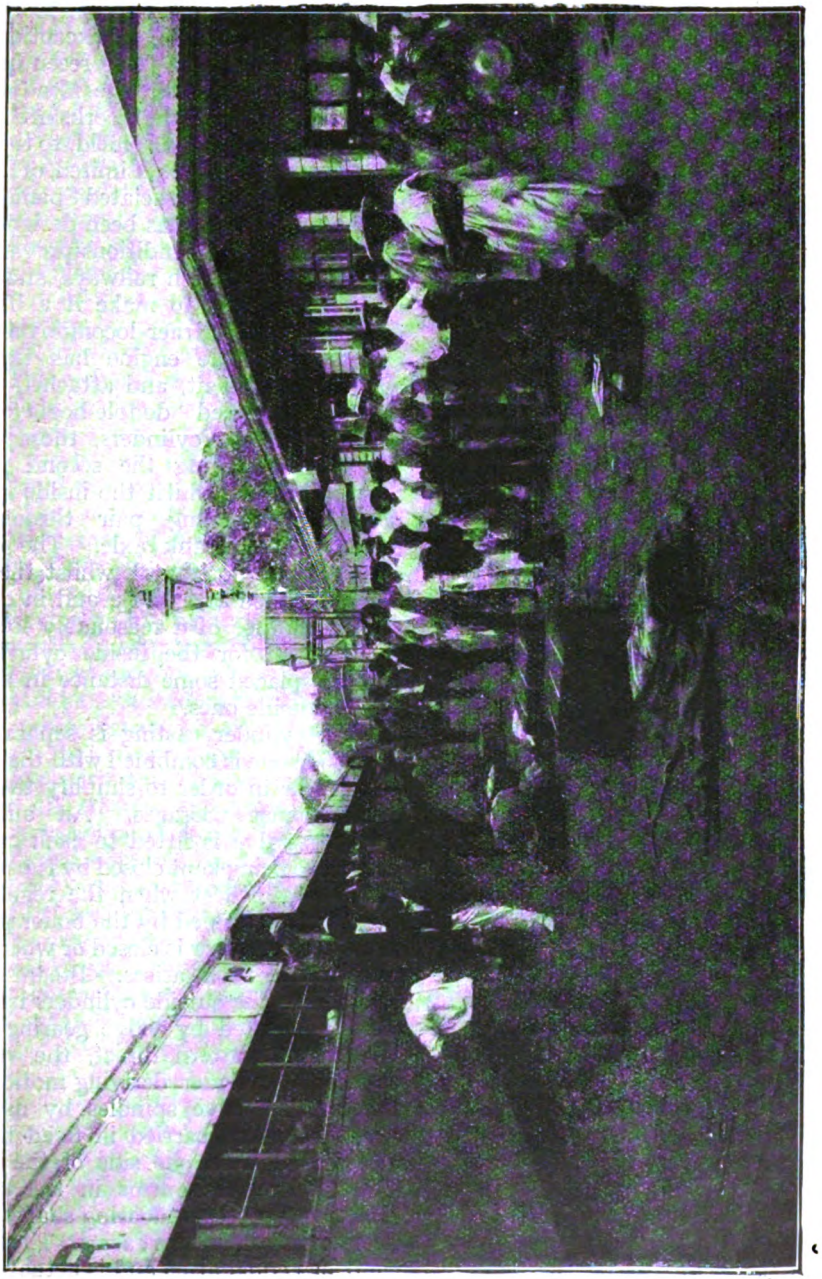

BEKWAI STATION, GOLD COAST GOVERNMENT RAILWAYS.

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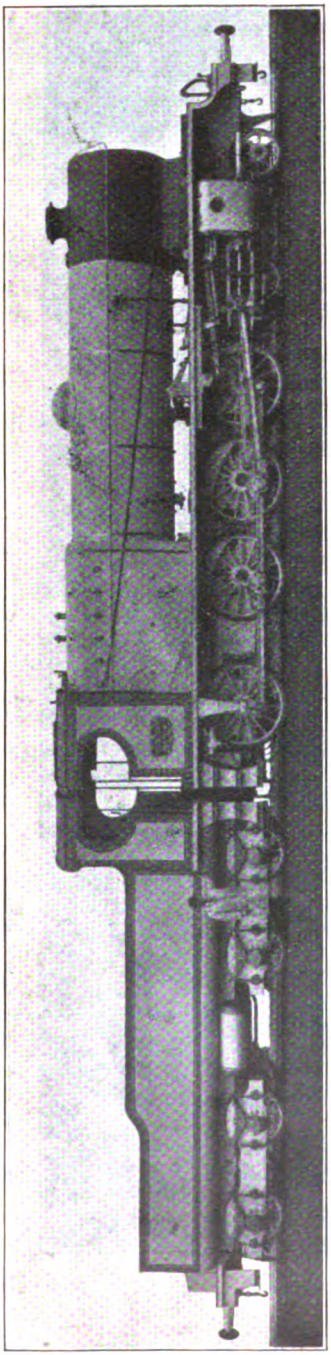
A Remarkable 4-8-0 Three-Cylinder Locomotive for Spain.



A LOCOMOTIVE of exceptional size and power has recently been completed at the Meadow Hall Works of the Yorkshire Engine Company, Limited, Sheffield, to the order of Babcock and Wilcox, Limited, of London, on behalf of their associated Spanish Company. The engine has been designed and built to meet the conditions prevailing on the principal Spanish railways, and with a view, if possible, to make it a basis for manufacturing further locomotives of the same type. The engine has the 4-8-0 wheel arrangement, and attached to it is an eight-wheeled double-bogie tender. There are three cylinders, those outside the frames driving the second pair of coupled wheels, whilst the inside cylinder drives the leading pair through the medium of a crank axle. The outside cylinders are horizontal, whilst the inside one is inclined at 1 in 15, and in order to permit the use of a reasonably long connecting rod for the inside cylinder the latter is placed some distance in advance of the outside ones.

Each cylinder casting is separate, but the inside one is combined with the smokebox saddle in order to simplify the steam and exhaust passages. An automatic bye-pass valve is fitted to each cylinder, this valve being kept closed by the pressure in the steamchest when the regulator is open, and is opened by the boiler pressure when the regulator is closed or when excessive compression arises. Steam is distributed to the outside cylinders by piston valves actuated by valve gearing of the Walschaert pattern direct, the valve of the inside cylinder deriving motion from the outside valve spindles by means of a rocking shaft carried in fixed bearings and driven from one side of the engine. This shafting has arms in the ratio of 2 to 1 and carries a floating shaft in bearings formed on its short arms. The floating shaft has equal arms and is actuated from the other side of the engine.

The crank axle is of circular section throughout, being formed from a single forged cylindrical piece bent to shape.

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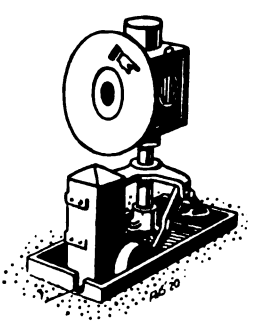
This construction ensures that the grain of the material runs parallel with the centre line of the axle, a feature which ensures long service. The boiler is of very large proportions and is fitted with the raised Belpaire firebox. As the fuel to be used is of very poor quality a large grate area is essential, and in order to obtain this, in conjunction with a deep firebox, the "Orleans" type has been adopted. Similar fireboxes are in use on the Norte Railway of Spain. The superheater and regulator are of the Babcock and Wilcox patent type. The superheater has two headers, one for saturated and the other for superheated steam, both being constructed of wrought steel. They are held in position by a casting on the smokebox tubeplate, which contains the regulator valve. This valve is of the hollow piston type, and is so arranged that when it is in the closed position steam is free to circulate from the boiler through the elements and regulator valve back to the boiler. The moment the regulator is opened the return of steam to the boiler is cut off, thus this one valve obviates the use of circulating devices, dampers and other similar mechanism, and, moreover, prevents involuntary starting of the engine. Automatic bye-passes are fitted to each cylinder, other equipment including a steam brake acting on all the coupled wheels of the engine and working in conjunction with the vacuum automatic brake on the tender and train. Steam sanding apparatus is fitted for forward and backward running, and the leading sand boxes can be operated mechanically.

Other features of the equipment include: Dewrance's water gauges and protectors; Dewrance's check valves; Gresham and Craven's No. 10 hot water injectors; Gresham and Craven's "Dreadnought" ejector; Gresham and Craven's steam sanding; "Heintz" steam heating; "Detroit" six-feed vacuum lubricator; Steinle pyrometer; Hasler speed indicator and recorder; Ross pop safety valves United States metallic packing.

Principal particulars are as follows:—

Cylinders	20½ in. by 26 in.
Diameter of coupled wheels	5 ft. 1⅞ in.
Diameter of bogie wheels	2 ft. 9⅛ in.
External diameter of boiler barrel	5 ft. 10⅞ in.
Number of tubes of 5¼ in. external diameter	27
Number of tubes of 2 in. external diameter	218
Length between tubeplates	16 ft. 4⅞ in.
Heating surface—	
Tubes	2,450 sq. ft.
Firebox	198 sq. ft.
Total	2,648 sq. ft.
Grate area	50 sq. ft.
Superheating surface, external	507 sq. ft.
Weight of locomotive in service	86·6 tons
Weight, adhesion	61 tons
Boiler pressure	185 lb. per sq. in.
Tractive force	36,873 lb.
Water capacity of tender	4,840 gals.
Coal capacity	7 tons
Weight of tender (in service)	50 tons
Total weight in service, engine and tender	136·6 tons
Total wheelbase	62 ft. 1½ in.
Total length over buffers	76 ft. 2½ in.

Continued increase in the weight of trains, combined with severe and continuous gradients, have created a demand for very powerful locomotives in Spain, but at the same time it is a matter of considerable difficulty to meet the demand owing to the fact that axle loads have to be greatly restricted. For this reason, and with a view to meeting the conditions in the best possible way, the peculiar advantages of the three-cylinder system have been resorted to in this design.



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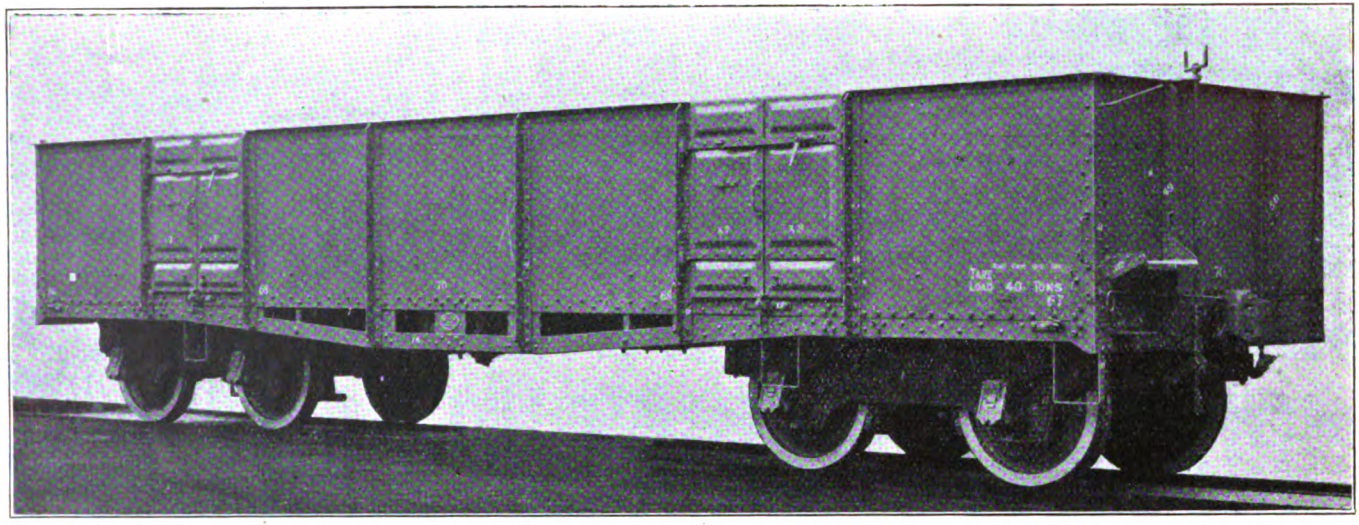
40-TON STEEL COAL WAGONS FOR CHINA.



BUILT by the Metropolitan Carriage, Wagon and Finance Company, Limited for the Pekin-Mukden line of the Chinese Government Railways, to the specification of Messrs. C. P. Sandberg, Consulting Engineers, the contract being for several hundred vehicles. The wagons are built of mild steel throughout, with the exception of the main under-frame members which are of high tensile steel. General dimensions are: Length, 38 ft. inside; width, 9 ft. 5 in. inside; depth, 4 ft. 6 in. inside; centre of bogies 26 ft.; wheelbase of bogies, 6 ft.

Bogies are of pressed steel, with side laminated bearing springs over the axle-boxes, and the wheels are of the solid disc type fitted with rolled steel tyres. Two double vertical doors of pressed steel are provided at each side of the wagon and secured by simple and handy bar and cotter fasteners. The central automatic couplers are of the Janney type.

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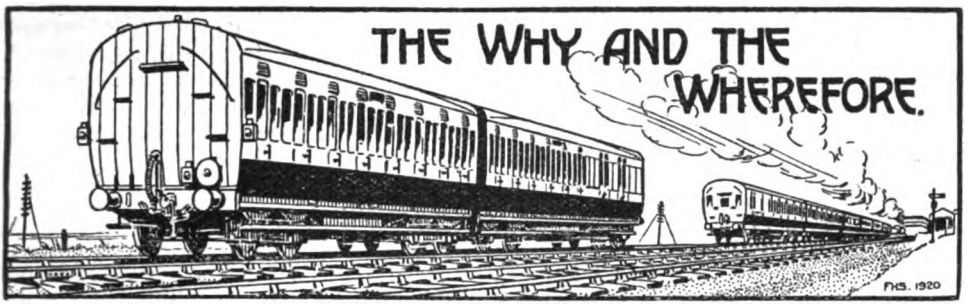

RAILWAY MAGAZINE *readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to locomotive sheds and to the dimension of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. No reader should forward more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history and the like, readers should consult the pages of the "Railway Year Book." The twenty-fourth Annual Edition of this standard railway reference work is on sale, 5s. net, or by post, 5s. 9d. A new edition, to be published in April, 1922, is nearing completion.*

Locomotive Horse-Power.

We have not space here to enter into a treatise on the theory of the steam locomotive; you must refer to text-books on the subject. There is no definite relation between tractive effort and horse-power; the former is a purely nominal figure, of limited significance, whereas indicated horse-power is an actual figure requiring for its calculation the mean effective pressure developed in the cylinders, which can only be obtained with accuracy fron indicator diagrams, although as Mr. Cecil J. Allen has pointed out in recent articles on "British Locomotive Practice and Performance," i.h.p. may be deduced in an approximate way from running speeds. Had you read these articles carefully, you would see how utterly impossible such a figure as 26,000 is to represent the horse-power of a locomotive; obviously you are confusing working steam pressure and mean effective pressure—two entirely different things. Very few, if any, British locomotive types are capable of an i.h.p. in excess of about 2,000.

[Reply to G. E. H. ROBERTS-HAY-BOYD AND H. W. OGG.]

Great Central Railway Stock.

New 60 ft. by 8 ft. 10½ in. corridor coaches average 34 to 36 tons each, restaurant cars 39 tons, and about 2 tons per vehicle additional to these weights for the anti-collision appliances, when fitted. You may read the weights of all these new vehicles on small cast-iron plates just above the footboard at the right-hand end of each coach, and the same applies to the new non-corridor stock. The older 45 ft. and 50 ft. corridor coaches weigh 29-30 tons, 8-wheeled restaurant cars 38 tons, and 12-wheeled open restaurant cars 38 tons. Non-corridor old bogie stock, about 28 tons per vehicle. The main line stock of the Great Central Railway average a greater tare weight in proportion to its accommodation than that of any other British company.

[Reply to "POONA."]

Articulated Trains, Great Northern Railway.

Mr. H. N. Gresley, on placing the point you raise before him, replies that it is correct that if any defects arise in any of the vehicles forming part of an articulated train which will necessitate the vehicle being taken out of traffic, the whole set must be taken out, but this difficulty applies equally in the case of ordinary carriages forming suburban trains, in that it is the practice to chain these trains into complete units and if any defect occurs, the whole train is taken out of service. In the case of the articulated trains, the bodies can, however, be easily detached from one another and lifted from the bogies, but this can only be done in a repair shop, and not in traffic sidings.

[Reply to "ITALY AND J.M.M."]

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Euston Square Station.

This was originally, and until comparatively recent years, known as Gower Street, which thoroughfare it serves directly. The present name indicates that it is near Euston, though by describing it as Euston Square the suggestion is conveyed that it does not directly serve the London and North Western Railway terminus. As the latter lies well back from the main road it was presumably thought best in early days to consider the traffic importance of Tottenham Court Road in locating the station, especially as it was not desired to deviate from the line of Euston Road to reach the London and North Western Railway station directly.

[Reply to "NORTHERNER."]

Inside Cylinder Locomotives, Great Western Railway.

The "Flowers," "Atbaras" and earlier 4-4-0's, such as the "Cities" and "Badminton" classes, with a few special engines, including the "Gooch" series, are now all classed generally together. Most have 6 ft. 8 in. coupled wheels. There are also the 5 ft. 8 in. classes, the "Duke of Devonshire," "Camel," and other mixed-traffics. In addition there are many 0-6-0's still in service, while the older 2-6-0 goods class also has inside cylinders. See list of Great Western Railway locomotives mentioned in advertising pages.

[Reply to "X.Y.Z."]

Great Eastern Railway Signal Boxes.

Between Liverpool Street and Stratford Central Junction the names are as follows:—Liverpool Street East and West, Bishopsgate South (L. and T. lines only), Bishopsgate North (S. lines only), East London Junction (T. lines only), Middle Box (L. and S. lines only), Bethnal Green West Junction, Bethnal Green East Junction, Devonshire Street, Canal, Coborn Road, Bow Junction, Bridge, Stratford Western Junction and Stratford Central Junction. "L."=Local, "T."=Through, "S."=Suburban.

[Reply to H. A. POPER.]

Junctions at Savernake.

We are not aware of any regular booked workings over the two curves connecting the G.W.R. West of England main line and the Midland & South Western Junction Railway at Wolfhall Junction, Savernake. Military traffic frequently passes over them however, to and from the Tidworth district etc., and both curves were very extensively used during the war. There is no physical connection between these two railways at Marlborough.

[Reply to G. N. SOUTHERDEN.]

Railway Grouping.

It is not clear yet how the joint lines which have their own rolling-stock will be dealt with under grouping. The Midland and South Western Junction Railway is to go into the Western group. There will be no division of railways, so that Midland lines west of Birmingham will go with the rest of the system in the North Western, Midland and West Scottish group. The Manchester and Milford Railway was taken over by the Great Western Railway some years ago.

[Reply to "J. F."]

Welsh Narrow-Gauge Railways.

All have been described in the RAILWAY MAGAZINE, though none recently. Space will not permit of a list being given, and your best course would be to consult a file of volumes in a Public Library, unless you know a reader who has a set, or are a member of the Railway Club. The Cambrian and other lines concerned might be able to assist you in regard to lantern slides, or you might apply to the Locomotive Publishing Company, 3, Amen Corner, E.C.

[Reply to "B. RLY."]

Express Train Loading.

British express trains range between about 250 and 450 tons. The Anglo-Scottish expresses are usually heavy and rarely less than 350 tons. Other expresses vary considerably, but there are many which load to 350 tons or even more which are operated on fast schedules. We note your remark, that on the Turin-Rome section of the Italian State Railways the average load is about 380 tons (metric).

[Reply to "ITALY."]

Indicator Shelters.

The structure you noted upon London, Brighton and South Coast Railway locomotive No. 329 *Stephenson* is a shelter to accommodate representatives of the locomotive department while taking indicator diagrams or conducting other tests. We

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have on several occasions reproduced photographs of engines to which the indicator shelter used by the railway concerned had been temporarily fitted.

[Reply to D. S. G. SHORTIS AND R. G. BOLTON.]

Metropolitan District Railway Headcodes.

The five lights used for headcodes are placed thus, as seen approaching :—

A
B D
C E

Trains terminating at Aldgate East have one at A only; Charing Cross (East bound) on Sundays, C, D and E; Parsons Green (both directions), C, D, E; Turnham Green (East bound) A, B, C, D and E. In the case of specials, one light is blue instead of white, respectively at A, C and C in regard to the three destinations first mentioned. Trains are only reversed at St. James' Park in cases of emergency.

[Reply to H.L.H.]

Lancashire and Yorkshire Railway Locomotives.

We note that one of Mr. Hughes' four-cylinder 4-6-0 locomotives has been used between Crewe and Carlisle. These have relatively small tenders as water troughs are numerous on the L. & Y. system. If there is ice on the water it may not always be practicable or desirable to pick up; hence some of the water stops you have noted.

[Reply to S. COWAN, Junr.]

Roudham Junction, Great Eastern Railway.

This "Exchange Station Only" was described some years ago in these pages. It is provided to enable certain main line and branch trains to exchange passengers where time would be too limited at Thetford. At present no connections are made in this way, and the branch trains which call, one in each direction, presumably do so for staff purposes.

[Reply to S.H.J.]

Coventry and Leamington Line, London and North Western Railway

Have no details of collapse of railway bridge on this section in 1862 or thereabouts. Possibly a reader interested in early railway history may be able to supply desired information. With regard to accident near Leek Wootton, in 1861, we could not ascertain, without extended research, after this lapse of time, the class of engine involved.

[Reply to G. W. BISHOP.]

Caledonian Railway Summits.

Cobbinshaw Summit, between Edinburgh and Carstairs, is 880 ft. above the sea, against the 1,015 ft. of Beattock Summit. From Slateford for 10 miles the grade averages 1 in 150, but the final 5½ miles past Harburn to the summit are at 1 in 100—a longer incline than the south side of Beattock, but less steep. We have not by us the altitude figure at Benhar.

[Reply to A. A. TORRANCE.]

Chamfered Rail Joints.

Experiments have been made on many occasions, and no doubt the example you noted on the South Eastern & Chatham Railway is a further one, with rail joints wherein the ends of adjoining rails are chamfered as indicated by your sketch. The object is to get a continuous rail surface at the joints. There are now eight 2-6-0 engines of the "810" class.

[Reply to "C. F. F."]

"The Great Bear."

There is nothing very unexpected in the fact that *Chums* presented a colour plate showing a Great Western express between Dawlish and Teignmouth drawn by *The Great Bear*. That this engine does not work, if it ever has worked, west of Exeter is a point which would hardly come under the notice of the editor of this publication.

[Reply to B. STEWART-BROWN.]

Royal Specials.

When necessary, these receive attention in the pages of the RAILWAY MAGAZINE, and if photographs are available, they are usually reproduced. But unless special working or notable schedules are involved the general newspapers give all the information necessary, as by the time the RAILWAY MAGAZINE is published the matter has lost its topical interest.

[Reply to "W.L.S."]

Norton Fitzwarren Accident.

This occurred on November 10, 1890; 10 persons losing their lives. A down goods train had been shunted to the up line to enable a special mail train from

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Plymouth to pass, and the former was overlooked by the signalman who gave line clear for the latter.

[Reply to H. C. L.]

" Railway Year Book " and Grouping.

The 1922 edition will include full particulars of grouping and other matters associated with the Railways Act, 1921, but until grouping is an accomplished fact the railways will, of course, be dealt with separately as heretofore, except for amalgamations already effected.

[Reply to " B. RLY."]

Locomotive Working at Banbury.

We note that in your experience Great Western and Great Central locomotives were interchanged at Banbury, and that the Great Western engines do not now work through to the Great Central Railway. Presumably, this is the present arrangement.

[Reply to " SCHOOLMASTER."]

Triangular Stations.

Mr. W. M. Shawe Tayler specifies Attymon Junction, Midland Great Western Railway, Ireland, where the Loughrea branch joins the main Dublin-Galway line, as a further example. Platforms on all three sides are used regularly.

[Further reply to F. A. RANSOM-COWLISHAW.]

Prize Lengths.

Periodical inspection of track upkeep and maintenance on the Great Eastern Railway are followed by the award of prizes to the track gangs responsible, and a notice is put up in accordance, as noted by you outside St. James' Street station, Walthamstow.

[Reply to M.B.C.]

Midland Railway.

The Midland was one of the first railways to do away with second-class. This occurred in 1875. The Midland introduced Pullman cars in the same year, but none are now used. A few remain in existence, the bodies being used as yard offices in sidings, etc.

[Reply to " X.Y.Z."]

Painting of Carriages, Great Western Railway.

It is not improbable that some of the special trains, such as the Cornish Riviera express, will appear in a different livery to that at present standard, but we have no official information on this point.

[Reply to " W.L.S."]

Cardiff-Newcastle Through Coaches.

Mr. H. G. Beachey points out that before the war a through coach for Newcastle left Cardiff at 7.40 p.m., returning from Newcastle about 7 p.m. The route was via Pontypool Road, Hereford, Shrewsbury and Crewe.

[Further reply to" BOLTONIAN."]

Steam Regulators.

By this is understood the regulator by which steam is allowed to pass or not to the cylinders. The valve you specify in connection with a special superheater device, is of a " regulating " character, but is really a different device.

[Reply to J. WILLOUGHBY.]

London Electric Railway Extension.

Work has not yet been commenced on the connections from the Central London Railway to the disused London and South Western lines at Ravenscourt Park, though Parliamentary powers have been obtained.

[Reply to R. KIRBY.]

London and North Western Railway Locomotives.

We understand that one of the Webb four-cylinder 4-4-0 locomotives has been fitted with superheater. See notes in " What the Railways are doing," on locomotive happenings at Crewe.

[Reply to B. S. BROWN.]

Converted Locomotives, South Eastern & Chatham Railway.

We are not aware of any other than the Wainwright 0-6-0 tender goods class, some of which have been converted to saddle tank engines, of which No. 685 is an example.

[Reply to L. S. PEGRUM.]

Welwyn Viaduct.

Answer given on page 132, February RAILWAY MAGAZINE, concerning Digswell Viaduct, Welwyn, Great Northern Railway, contained a misprint. The *height* of the viaduct is 98 ft. The length is 1,560 ft.

[Reply to " F.P."]

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London and South Western Railway Power Classification.

This question has been answered several times before. The lettering on the side framing at the leading end of the engines represents a classification according to power.

[Reply to R. A. WHEELER.]

Highest Speeds.

See " Railway Miscellany " in RAILWAY YEAR BOOK. The highest record is of 102 m.p.h. by Great Western Railway 4-4-0 engine *City of Truro*, descending Wellington Bank. Safety at high speed is entirely a matter of conditions.

[Reply to W. D. PORTER and J. E. MORDUE.]

Interchanging " Tube " Cars.

When this is necessary in the case of lines which have no physical connection, even by a roundabout route via surface railways, cars are occasionally transferred by road.

[Reply to " R. G. H.]

Woodford Junction, Great Central Railway.

We understand that the line from Woodford South Junction to Woodford West Junction, South Midland Railway, was never made, though prepared for.

[Reply to R. KIRBY.]

4-4-2 Tank Engines, London & South Western Railway.

Most of these are now on the duplicate list, but officially 79 are still in service. They are principally employed on country branches and routes.

[Reply to H. G. M. ROGERS.]

Railway Statistics.

For comparative railway statistics, see RAILWAY YEAR BOOK. Also for particulars of colours of engines and rolling-stock, and much other information.

[Reply to I.H.L.]

Cornish Riviera Express, Great Western Railway.

A four-cylinder 4-6-0 is always employed for this train. It works through from Paddington to Plymouth, and works back next day.

[Reply to K. H. DIXEY.]

London & North Western Railway Running Powers.

These are exercised over portions of the Metropolitan District Railway, but not over the Metropolitan.

[Reply to " ITALY."]

Isle of Wight Locomotives.

We cannot go into comparisons between individual engines. Why not calculate tractive effort for yourself, from the dimensions.

[Reply to " BONCHURCH."]

No. 1506, Great Eastern Railway.

This engine had to be broken up after the Colchester accident on July 12, 1913, and the number is still vacant.

[Reply to " G.E.R. TRAVELLER."]

Portland Road Station.

Now known as Great Portland Street, the old name was justified by local street nomenclature at the time it was built.

[Reply to " NORTHERNER."]

Marshalling Yards.

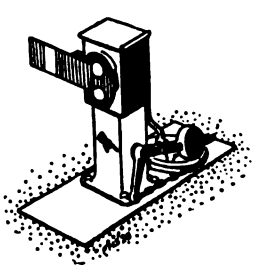
Your query is partially answered by data given in RAILWAY YEAR BOOK. Beyond that we have no details.

[Reply to J.O.R.]

Electric Train Heating.

In electric trains, electric heaters are installed under the seats.

[Reply to J.M.M.]



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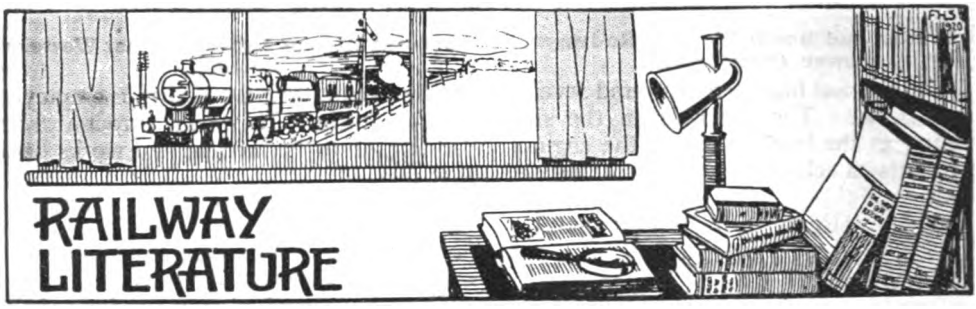


OFFICIAL YEAR BOOK OF THE LONDON RAILWAYS ATHLETIC ASSOCIATION. [Compiled by D. H. F. Meacock, (Publicity Dept., L & N.W. Rly., Euston Station, London, N.W.1). Price 1s.]

Major-General Sir Henry W. Thornton, K.B.E., General Manager, Great Eastern Railway, has written a "fore-word" to Mr. Meacock's admirable year book. Sir Henry is the popular president of the Association for 1921–1922, and Mr. Meacock is the well-appreciated chairman of council for the same period. From the presidental letter the following may be quoted:

"A man with a healthy body is naturally active, whilst a man who neglects his physical powers has to be induced to exert himself. The Association has room for all and provides an antidote for the business troubles and worries, with which, at some time or another, everybody is afflicted. It brings together in brotherhood and the friendly rivalry of sport the staffs of all London railways, and gives great impetus to team work —an essential feature for success, either in business or pleasure. Friendly rivalry begets mutual esteem; many a casual meeting on the playing field has led up to a close friendship and at the present moment, when we are all in the throes of amalgamation, it is more desirable than ever that the spirit of good fellowship should be fostered. Long may the Association flourish!"

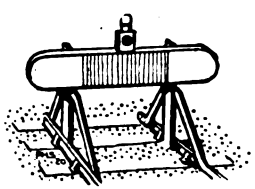
Mr. Meacock is to be congratulated on the production of a book which will not only serve a useful purpose during the current year, but will likewise be found a work of considerable historical value in the years to come.

FACTORY ACCOUNTS IN PRINCIPLE AND PRACTICE. [Garcke and Fells. Crosby, Lockwood & Son. Price 15s. net.]

THIS, the seventh edition of a standard and highly appreciated work, emphasises the possibilities of attaining a high degree of accuracy in regard to factory book-keeping. In the foreword, by Mr. J. M. Fells, C.B.E., economic, legal and other aspects are discussed, while subsequent chapters deal with labour, stores, prime cost and the cost ledger, indirect or incidental expenses and their allocation, fixed capital and depreciation, machinery use, stock, surveys, subsidiary books, &c. Tables of specimen rulings and three appendices add to the value of this work.

POCKET ATLAS AND GUIDE TO LONDON. [John Bartholomew & Son, Ltd. The Geographical Institute, Edinburgh. Price 2s. net.]

This useful little work has been before the public for many years, and the rapidity with which every large edition has been sold is ample testimony to its merits. The 1922 Edition has been carefully revised and may be relied on for its accuracy. Besides the sectional street plan, maps of the railways, postal districts, and metropolitan boroughs, the book is furnished with a pictorial map of central London; useful maps of the surrounding districts, and ground plans of the Tower, St. Paul's, and Westminster Abbey, on the latter of which is shown in this edition the position of the "Unknown Warrior's" grave. For the Londoner this pocket atlas and guide is extremely useful, but for the visitor to the metropolis it is an absolute friend.



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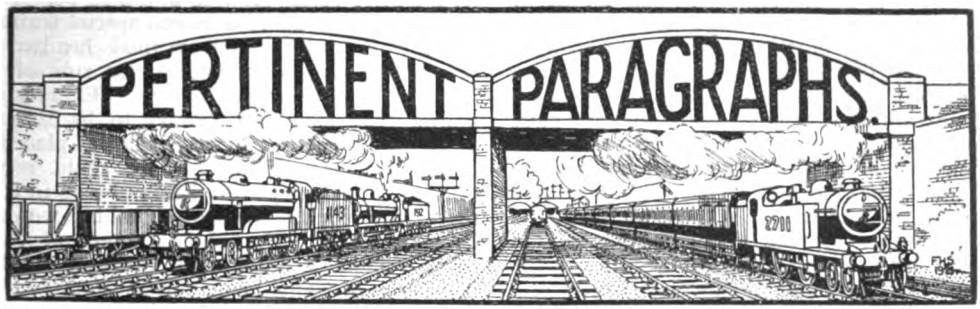

The Railway Meetings.

PARTICULARLY interesting this year, in that the respective chairmen dealt with so many live aspects of the railway situation, the general note was that it has only been the availability of part of the allocations from the Government grant in settlement of war-period claims which has enabled most of the companies to maintain last year's dividends, and in some instances to improve thereupon. Notwithstanding the depressing nature of the statistical aspects as a whole, and the fact that this source of special financial assistance has been largely utilised (several companies have, however, managed without adopting this course) the outlook as a whole is fairly favourable. In the Western group amalgamation proceedings are well under weigh, but in most other cases the chairmen's speeches chiefly emphasised the complicated nature of the problems involved. The Railways Act, 1921, figured, indeed, very prominently in all cases. At the same time, it is a favourable sign that the general tone of the remarks made were optimistic, and this augurs well for the conduct of the complex negotiations which must be the order of the day throughout the rest of the year.

As Government control and guarantee applied until August 15, 1921, the statistical and traffic tables included in the Annual Reports are necessarily continued in the abbreviated and adapted form adopted during the war-period. Almost invariably, however, the statistics show serious diminutions as compared with 1920. Passenger totals are very much down, especially in the first class, but in considerable ratios also in regard to other classes and workmen's traffic. Freight tonnage is also down, and the only feature directly favourable in this respect is the fact that numbers of head of live stock conveyed are frequently greater than in 1920 or only slightly less. The reductions under all other heads were, however, so largely attributable to the coal strike and national depression of last year, that the prospects for 1922 must almost certainly be very much brighter. A noteworthy item is that both the London, Chatham and Dover and Metropolitan District Railways declared dividends on stocks which have not participated for many years, since 1882 in the latter case. At several meetings the chairmen spoke most favourably of the services rendered by present chief officers and those who retired during last year.

Pre-Grouping Amalgamations.

BY the end of this year the main principles upon which grouping according to the Railways Act, 1921, is to be carried out will have to be settled. Meanwhile, several amalgamations are already in process. That of the London and North Western and the Lancashire and Yorkshire Railway is already completed; and that of the Hull and Barnsley with the North Eastern is well advanced. In the case of the South Eastern and the London, Chatham and Dover Railways, it was pointed out at the last annual meeting that the Act creates an anomalous position in that the Managing Committee is regarded as a constituent company, though it has no shareholders and no capital. However, the amalgamation of the two companies, now in process, will automatically remove this anomaly. As Mr. H. Cosmo O. Bonsor, Chairman, stated: "It is obvious that the interests we represent in this Committee will be strengthened, especially for the purpose of amalgamation with the other companies of the Southern Group, by the complete fusion of the South Eastern and Chatham Companies and the consequent disappearance of the Managing Committee. Representing, as it does, both the South Eastern and the Chatham Companies, the Managing Committee is unanimous that this fusion is necessary."

At a special meeting of the proprietors and debenture stockholders of the Great Western Railway on Thursday, February 23, Viscount Churchill announced that agreement had been reached as to the terms of amalgamation with six Welsh constituent railway companies

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who are to be amalgamated with the Great Western Railway Company. The proprietors and debenture stockholders of the Taff Vale Rhymney, Cardiff, Cambrian, and Alexandra (Newport and South Wales) Railway Companies, and the Great Western Company have now confirmed the arrangements made by their directors, and a preliminary scheme of amalgamation will be at once submitted to the Amalgamation Tribunal for approval. The scheme for the amalgamation of the Barry Railway is to be submitted later, the terms of settlement, though agreed, still requiring endorsement by the respective companies. He also pointed out that the Great Western is the first company to carry out the provisions of the Railways Act, 1921, the action which has so far been taken being designed so that, if approved, the amalgamations will operate as from January 1, 1922. This great combination will bring under one direction an undertaking representing a total capital expenditure of nearly £162,000,000, its operations covering an area stretching from London to Penzance, a large portion of the Midlands, with important interests in North and South Wales and many other centres. Included will be the important railway-owned docks at Newport, Cardiff, Penarth, Barry and Port Talbot, all of large capacity and equipped with up-to-date appliances. In fact, with the exception of Swansea Docks, this amalgamation will bring within the scope of the new Great Western Company a chain of docks, ports and harbours stretching right across South Wales from the River Severn to Fishguard Harbour. Incidentally, about 60 per cent. of the export coal of Great Britain is shipped from the South Wales docks and ports.

Making-up Lost Time.

IN commenting upon Lord Monkswell's article published last month, "C.E.T.J." suggests that while most people will agree with the general substance, his (Lord Monkswell's) reasoning "is surely unsound in his concluding remarks under the sub-heading 'Each Train in its Place.'" Continuing, our correspondent refers to Lord Monkswell's suggestion "that the Gretna accident in 1915 would not have occurred if the express had not been late." True, similarly at the time of the Aisgill accident in 1913, some people said that the accident would not have occurred if the engine of the first train had not failed. At the same time others said that if the two trains had been running with an interval of (say) half-an-hour between them, instead of about ten minutes, it is probable that the first one would have been able to re-start and get clear before the second one came up. There is some truth in that also. Arguing on the same lines, some ill-informed persons say that it is dangerous to run special trains because it reduces the normal headway between trains; which is of course, rubbish!

As C.E.T.J. points out: "Everyone knows that there are bound to be times when trains get out of their normal places. It is often unavoidable. If we could rely absolutely on every train being always in its place, the block system of signalling would be superfluous. The whole essence of the block system is that, when properly used, it permits of trains being run at short headway, and it protects trains which are out of their place; and we are entitled to rely on this protection. So that the proper line of enquiry in case of accidents is not 'Why was this train late?' nor 'Why did that one make an involuntary stop?' nor yet 'Why do they run trains at an interval of only ten minutes?' The line of inquiry should be: 'Why did the signalling system fail to give proper protection to this train which (for some reason which does not concern us) was out of its place?' Lord Monkswell's remarks about the scope of the instructions given to Board of Trade inspectors are not, therefore, to the point."

"With Lord Monkswell's earlier remarks as to the desirability of making up lost time, I am in entire agreement. But if he says that it is dangerous not to do so, he is making railway travelling sound a great deal more dangerous than it is. Moreover, one can use against him with equal force the old woman's argument that it is dangerous to attempt to regain time because the driver may become so engrossed in this attempt that he will take risks such as, for instance, taking curves too fast. Apart altogether from the foregoing, I imagine that the locomotive engineer's point of view is that attempts to regain time may lead to overstraining engines, and they are probably averse to it for that reason. In many cases, of course, there is not a sufficient reserve of power available to regain any appreciable amount on schedule. But I personally do not think either of these considerations provides an adequate reason for not attempting to make up as much lost time as possible."

Further Comments.

MR. R. C. FINNEY, of Leicester, also writes in regard to the article published in the March RAILWAY MAGAZINE: "I cannot agree that Lord Monkswell's strictures against British railways on this account are either justified or convincing; at any rate, so far as our northern lines are concerned. True, I am only an amateur on railway matters, but even to me it seems that the conditions obtaining in the Continental cases specifically mentioned by Lord Monks-

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well were vastly different from those to be found in this country. The Calais-Paris train which gained 20 min. on an 81¼-mile run from Amiens to Paris, was allowed 103 min. for the journey—surely a very easy schedule when it was capable of being performed in 82 min. A run of this length in England under similar conditions would probably have an allowance of 85 min., and be considered 'easy' at that! The schedule of the other run (99 miles) in which 35 min. was gained is not given, but one thinks it must have been absurdly generous. To take one concrete example in this country. The 3.20 p.m. from Marylebone is scheduled to cover the 103 miles between London and Leicester by the Great Central route in 109 min.; the Metropolitan portion of the route is by no means easy, and very hard running from Grendon Underwood junction to Leicester is necessary if time is to be kept. (During the war, when the timing was easier, the RAILWAY MAGAZINE noted a speed of over 80 miles per hour between Whetstone and Leicester). In the extremely unlikely event of this train being despatched from Marylebone even 5 min. after time, it would be manifestly impossible to improve upon the existing schedule. From Leicester 25 min. only are allowed for the 23½ miles to Nottingham (Victoria). Again it would scarcely be possible to improve upon the schedule, although with a light train I have known the distance to be covered in slightly under 24 min. But in any case, the gain would be negligible. For the 38½ miles thence to Sheffield, 48 min. are allowed, but here hard roads, sharp curves and other obstacles to fast running begin to manifest themselves."

Time Regaining not Unusual.

"IT seems to me, therefore, that with the schedules at present in force on British railways there is very little margin for making up lost time; but, whether it be officially favoured or no, my own experience has been that in nine cases out of ten, a genuine effort has been made to recover time lost from any cause whatever; particularly on that most tightly timed of railways the Great Central. In the case of the Sheffield-Nottingham run, I have even known the schedule to be improved on when the start was punctual. I can quote, too, a war-time experience on the North Eastern, when travelling south by the 2.25 p.m. from Edinburgh (7.15 p.m. from Newcastle), after a stand of 13 min. for signals outside Durham we reached York at 9.45, only 5 min. behind the scheduled time—surely a remarkable recovery in a distance (between Durham and York) of 66 miles, with four intermediate stops. For many years I have been a constant traveller on the Midland, the Great Central, the Great Northern, and the North Eastern railways, all railways on which there is a tradition of high speed. In all cases the punctuality of the trains has been exemplary; and, as I have stated, when time has been lost, it has frequently been to some extent recovered.

"It is, I think, scarcely fair to hold up the Gretna accident of 1915 as an example of the results of unpunctuality. War-time conditions were admittedly abnormal, and trains, particularly the type of Scotch express in question, were so heavily loaded that the keeping of even the war-time schedule was by no means easy. There have been several bad crashes in France within the last year or so, and in at least one case the newspaper reports attributed the cause to high speed; though I agree with Lord Monkswell that this is rarely the cause of accidents. But in any case, with the standard of punctuality prevailing on most British lines, I do not think the travelling public has any need to be apprehensive as to accidents resulting from unpunctuality. Does not some significance attach to the fact that on our own railways, with their enormous volume of traffic, accidents are relatively few?"

Railway Signalling Progress.

THE Presidental address delivered by Mr. W. C. Acfield, O.B.E., Signal Superintendent, Midland Railway, at the annual meeting of the Institution of Railway Signal Engineers, included many points of interest. In introduction, Mr. Acfield referred to some of the pioneer signal engineers and the work they did in laying the grounds upon which modern railway signalling is based. Among these, he mentioned the names of Messrs. Spagnoletti, Tyer, Stevens, Saxby and Farmer, McKenzie and Holland, and Sykes, referring to the last-mentioned as the "Brunel" of the signalling world. With these, he coupled certain well-known gentlemen of to-day "who were the able successors of these great firms."

In regard to special developments in modern signalling such as track circuit—power signalling, automatic and three-position—colour light—beam light—and speed signalling, perhaps more progress has been made in the United States, but many important power and automatic signalling schemes have been installed in this country and our inventors are by no means idle. Mr. Acfield expressed the opinion that electricity and track circuit have been the means of the greatest advancement in signalling, the use of which enables hitherto considered impossibilities to be accomplished, while

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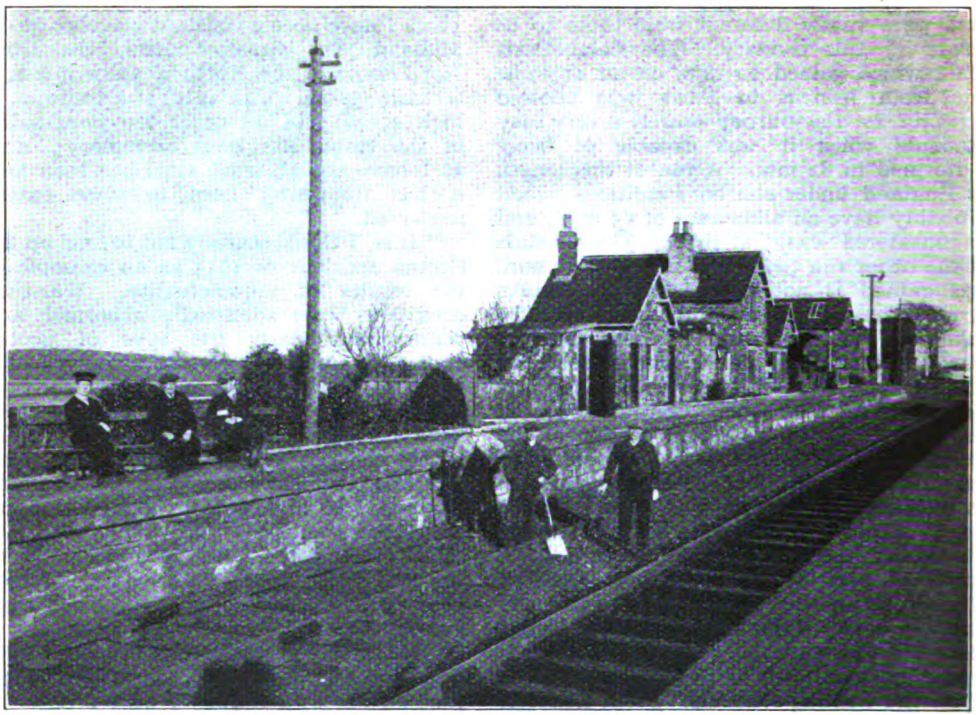

[*By Courtesy, North Eastern Railway Magazine.*

THE NORTH EASTERN RAILWAY OVER THE BORDER—SPROUSTON STATION.

This is one of the two stations in Scotland owned by the North Eastern Railway. Sprouston and Carham stations are both on the Kelso branch.

they are, of course, the very essence of automatic signalling.

Turning to three-position signalling he suggested that the methods of working and the class of traffic in this country are not "on all fours" with the problems for which three-position signalling was originally instituted. It does not necessarily follow that practice in America is, therefore, wholly suitable for this country, though "there is no reason why it should not be further investigated." In this connection he referred to Mr. Tattersall's paper recently read and discussed before the Institution and to the sub-committee appointed to investigate further this subject. Mr. Acfield predicted a great future for colour-light signalling, and referred to the recently published report of the Ministry of Transport Committee thereon. He was not, however, convinced that colour-light signals would be such a success in daylight as semaphore signals.

Train Control in America.

On the question of train control and particularly the news from America, which "came rather as a surprise to many," Mr. Acfield stated that he did not think it was realised in this country that any system had so far developed as to be considered to meet the requirements laid down. It appears that on January 10 of this year the Inter-State Commerce Commission of America ordered that 49 carriers would show cause, if any, on or before March 15 next, why the order of the Commission requiring them to make installations of automatic train control should not be entered. The Commission has decided not to limit by the order the installation of these devices to roads or parts of roads already equipped with automatic block signals, because it has no desire to discourage efforts for automatically controlling trains without the aid of fixed wayside signals. The developments of this order will be watched with the greatest interest by inventors and the railway world generally.

Mr. Acfield then devoted some attention to changes in rules and regulations, signalling requirements, &c. Thus, he pointed out, that the maximum distance some years ago for working facing points from a signal-box was only 150 yards, but we are now on the eve of the maximum distance being further extended, officially, from 250 to 350 yards,

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for all points operated manually. This will enable a saving to be effected by reducing the number of signal-boxes, particularly when dealing with passing loops on single lines. In the case of facing points worked by power the distance will be unlimited, and Mr. Acfield expressed the hope that we shall soon be hearing of some important developments in the working of points by power at great distances from signal-boxes, thus enabling some junction signal-boxes to be closed altogether, as this is one of the directions in which economies may be looked for.

The Press and Railways.

COMMENTING upon the fact that at one time little or nothing appeared in the press regarding descriptions of signal installations or improved methods of signalling, Mr. Acfield mentioned with appreciation that editors have risen to the occasion, "as we are now better informed of what is being done generally, and the articles on signalling matters are valuable and enlightening to all interested in the subject." In this connection we may also refer to remarks made at the annual dinner of the Institution of Locomotive Engineers, when Sir Alexander Richardson, of *Engineering*, replied to the toast "The Technical Press," proposed by Mr. R. H. Whitelegg, Chief Mechanical Engineer, Glasgow and South Western Railway. Sir Alexander said that the technical journal was a clearing house of technical thought, whence information as to what was being done was given out to other technical men. No one could afford to ignore the technical press, and he asked locomotive engineers to be liberal in their contributions to technical journals. What they gave was returned a hundredfold, as it encouraged their men to read and learn what was being done.

Steam and Electric Locomotive Shunting Tests.

IN view of the proposed electrification of main lines on the London, Brighton and South Coast Railway, an exhaustive series of shunting tests were recently carried out by Colonel Billinton, Locomotive Engineer, for steam operation and by Mr. Houghton, Electrical Engineer, for electric operation. There being very little experience of electric traction as applied to goods services in this country, and such data as is available in connection with steam haulage not being of a nature to give the information required for the report, it was necessary to investigate the actual conditions in practice very thoroughly, with a view to ascertain, particularly with regard to shunting and marshalling operations, the energy required and the savings which might be effected by electric operation. The results indicate that considerable economies should result from electric operation of these services, due both to accelerated shunting speeds and to saving of stand-by losses.

The speed of shunting operations adopted by the Ministry of Transport for statistical purposes is 5 m.p.h. The tests made show that this figure in practice is 2·71 m.p.h. for the whole time that the steam locomotive is in the yard.

The economies effected by electric operation are :—

(*a*) Increased acceleration, which re-acts upon wages, not only of engine crews, but also of shunters, by the time saved in shunting and marshalling operations.

(*b*) Stand-by losses are very considerably reduced, due to the fact that there are no energy losses while the locomotive is not in motion or is coasting.

(*c*) There are savings in time due to elimination of running for water as well as the fact that an electric locomotive can remain in service practically continuously for a very extended period, thus avoiding running to sheds for coal and other engine requirements.

(*d*) Saving in actual number of locomotives employed.

On the New York, New Haven and Hartford Railroad this saving has been found to be as three to five, or 40 per cent., but owing to the number of single engine yards on the Brighton Railway, this figure has been assumed for purposes of cost as 25 per cent.

Changes in G.W.R. Organisation.

REVISED arrangements with regard to road transport, locomotive operating and rolling-stock supply and distribution, became effective on the Great Western Railway as from February 20. By the courtesy of Mr. Felix J. C. Pole, General Manager, we are enabled to publish the following particulars, issued in a staff circular.

The Superintendent of Road Transport will be responsible, under the Superintendent of the Line and Chief Goods Manager, for the supervision of the whole of the company's road transport arrangements (passenger, parcels and goods), including those carried out by carting agents, and all communications from the divisional and district officers having reference to such matters should be addressed to Mr. F. C. A. Coventry, Superintendent of Road Transport, Paddington Station, W.2. Stationmasters and goods agents will communicate with the divisional and district officers as hitherto.

Mr. H. Simpson, Running Assistant to the

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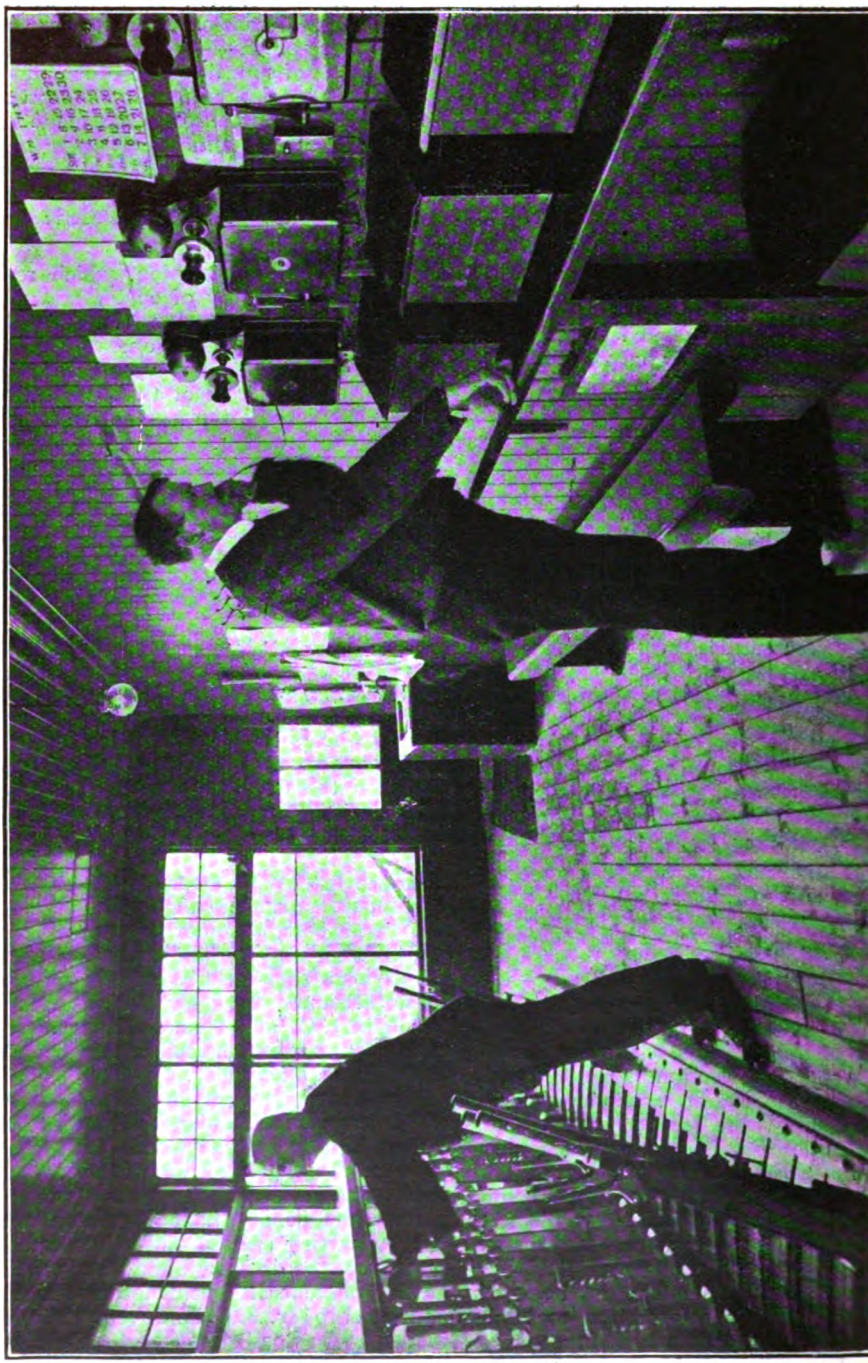

INTERIOR OF PORTOBELLO WEST SIGNAL CABIN, NORTH BRITISH RAILWAY.

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Chief Mechanical Engineer, has been appointed Locomotive Running Superintendent and Outdoor Assistant to the Chief Mechanical Engineer. He, and the Divisional Locomotive Superintendents through him, will be responsible to the Superintendent of the Line for the supervision of all purely locomotive operating work, including :—(1) The allocation and distribution of engine power ; (2) The preparation of engine working diagrams for passenger and freight train services ; (3) The examination of enginemen's records for passengers and freight train services ; (4) Hours of duty of enginemen. In regard to these matters Mr. Simpson will correspond in his own name, and all communications in respect of them should be addressed, Mr. H. Simpson, Locomotive Running Superintendent, Swindon. All other locomotive department matters will continue to be under the supervision of the Chief Mechanical Engineer, and in regard to these Mr. Simpson will correspond in the name of the Chief Mechanical Engineer.

The Rolling-Stock Inspectors will be transferred from the direct supervision of the Superintendent of the Line to that of the Divisional Superintendents, who will be responsible for the supply and distribution of rolling-stock in their respective divisions, subject to the over-riding control of the Superintendent of the Line, in conjunction with the Chief Goods Manager so far as his department is concerned. It is stated that District Goods Managers must keep in close touch with the Divisional Superintendents in regard to the wagon requirements in their respective districts.

Improved Suburban Services, South Eastern and Chatham Railway.

COMMENCING on Monday, February 13, the South Eastern and Chatham Railway brought into operation a new time-table for their entire system. Like most other railways, they have, since the war, experienced great difficulty in working a sufficient number of trains from the residential areas into London between 9.0 a.m. and 10.0 a.m., and, in order to increase the number, it has been necessary to revise the whole service between 7.0 a.m. and 10.0 a.m., and to introduce new and improved methods of working. The aggregate of trains that can be dealt with during the rush period is governed by the capacity of the tracks between London Bridge and Borough Market Junction, and, in order to utilise this section to the fullest extent, a careful study of the whole service has been made so that a suitable path may be given to each train, no matter what its starting point, and one that there is the least possibility of the train missing. Special attention has also been given to the requirements of the passengers changing at London Bridge from City to West End trains, or *vice versa*. For this purpose, the greatest possible use

Photo.] **LONDON & NORTH WESTERN RAILWAY. (Lancashire & Yorkshire Section).** [*F. E. Mackay.*

Mineral train near Mytholmroyd. 0–8–0 superheater locomotive, No. 246.

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has been made of parallel movements between New Cross and Cannon Street. Under the new methods, it has been found possible to increase the number of trains to 40, and the results for the first three days proved the new system to be an unqualified success.

Locomotive Performances.

WRITING in appreciation of the March RAILWAY MAGAZINE, Mr. R. P. Devas, of Newcastle-on-Tyne, remarks in reference to Mr. Cecil J. Allen's articles, "They are, in my opinion, just such as are wanted by the vast majority of your readers. We may not always agree with Mr. Allen in the praise he gives, nor always, on the contrary, in his strictures; but he supplies us with details which (whether or not we pride ourselves on any particular knowledge of the line or locomotive) enable us to form our own opinions." He then goes on to suggest that the RAILWAY MAGAZINE should deal occasionally with less favourable aspects of railway working, and as to this we join issue. Thus he raises again the question of bad runs and locomotive failures, as to which Mr. Allen has so fully and suitably replied. Obviously there is no point in describing bad runs, for even the best of engines has occasionally its "bad days," while frequently to give publicity to an unsatisfactory run would be, not to enlighten readers, who must know that now and then locomotive running is not up to standard, but to perpetrate an injustice to engine and enginemen. Some years ago we commented editorially on bad runs which were really good—that is, the enginemen had completed runs in the face of difficulties which, but for their capabilities, might have entailed the engine "coming off," yet, as a bare record of running the journey would be classed as bad, though it was good on the basis of the facts. Advisedly, Mr. Allen adopts the principle of dealing only with unsatisfactory aspects of runs when they are followed by notable compensating work. After all, even the habitual traveller has little to complain of, and the percentage of bad runs or time lost by engine is, in the experience of most of us, very small indeed. If any difference of opinion is justified, it is rather as to whether notable runs only should be chronicled, not as compared with unsatisfactory ones, but in contrast with the great majority which involve correct time-keeping and are therefore devoid of special incident.

Is Adverse Criticism of Railways fully Justified?

MR. DEVAS' letter suggests, though he does not go into this himself, except by inference, that in other ways also one is entitled to ask, "What is wrong with the railways?" In our opinion, expressed not on the basis of interestedness, but from fuller knowledge of the real facts than is the privilege of most of our readers, a great deal of the adverse criticism which it is now the fashion to level at railways is not justified. Bad time-keeping is usually the result of circumstances, and not of failure of men or material. Delays in goods transport are due as much to causes attributable to consignor or consignee as to inefficient work of the goods department. Awkward train services and particularly connections are often explained by the fact that it is impossible to fit in trains to connect at every junction point, while the traffic available would not justify the use of additional engines, rolling-stock and staff on branch and connecting services. And in regard to fares and charges it may be pointed out once more that, after all, and however hardly they may appear to hit travellers and traders, railways are commercial concerns, they must pay their way, and in most cases railway charges rank with other charges which include the same or even greater proportionate increases over pre-war levels. It is easy to suggest that cheaper facilities would create traffic, but while this is true to some extent the great difficulty is that, in large measure, there is not at present the traffic to be attracted. In regard to mechanical road transport, for instance, this has much to commend it from the user's point of view, but the tendency is for traders to use it only when it pays them, while the railways must operate all the time, and as often as not, the concessions asked for are in respect of goods which it does not pay to haul by road. With reviving trade and industry the railways will be able to do more to meet the demands of their "customers," or even to offer special inducements, but until then they, in common with passengers and traders, must "cut their coats according to the cloth." The tendency is towards the restoration of facilities and traffic attractions on a widespread basis, but a large proportion of the adverse criticisms now current suggest serious lack of knowledge of the real conditions of traffic, and incorrect appreciation of the actual problems which are being faced by railway officers. It would be possible to deal with railway delinquencies on the lines favoured by certain sections of the general press; but for publication in the RAILWAY MAGAZINE they would have to be prepared on very different principles, and much of the "spice" and sensationalism would be lost altogether, as being neither in accordance with facts nor justified.

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Institution of Locomotive Engineers.

COLONEL KITSON CLARK, M.Inst.C.E., Managing Director of Kitson & Co., Limited, presided at the annual dinner of the Institution of Locomotive Engineers, held at the Engineers' Club, London, on Thursday, February 23. Sir Henry Fowler, K.B.E., Past-President, Chief Mechanical Engineer, Midland Railway, in proposing "The Guests," said they were delighted to see there the President of the Institution of Mechanical Engineers. With regard to Sir Alexander Richardson, Mr. Whitelegg was going to speak about him later. Continuing, he said: "I now come to two names of those who, if they are not members, I hope will be before very long. We are very fortunate in our English railways at the present day in having four engineers as general managers. We as an Institution are particularly fortunate this evening in having two of those general managers present with us."

Sir Henry Thornton, K.B.E., General Manager, Great Eastern Railway, in the course of his reply, said: "I think we may flatter ourselves that we are citizens of that country which has the best war record in respect of transportation and has come out of the war with its railways and personnel in better shape than those of any other country. I had an interview last October with the German Minister of Railways. After some conversation he admitted to me that the British transportation machine was a good deal better than the German, and he said 'I don't know how you did it.' Well, we did it because we had such men as Sir Eric Geddes, and after him our distinguished guest, my colleague, Sir Philip Nash, not to mention Mr. Arthur Watson. At any rate, our railways performed prodigious feats during the war; and what we should be more proud of than anything else is that we have come out of the war financially and physically in better condition than the railways of France or America. That, I think, is an achievement of which we may be proud, and it is due to the industry, energy, capacity, and the high sense of duty which actuated all those who were engaged in the transportation industry. If we are going to make a success of amalgamation, it is going to be in a very large degree due to the efforts of those who are responsible for locomotive running. The great problem of locomotive running is how to arrange our schedules and so forth so as to come as nearly as possible to getting eight hours' work for eight hours' pay. There is greater opportunity for wasting money in locomotive running than in almost any other branch of the railway industry to-day, and it seems to me that it is one of the great problems that we shall have to rely upon our locomotive superintendents to pull us through."

Mr. Arthur Watson, C.B.E., General Manager, London and North Western Railway, in the course of his reply, said: "The one thing that makes above all other things for efficiency in railway operation is attention to the locomotive. It is the one thing that matters in railway expenditure—the locomotive hour. The difficulty to-day is that the locomotive hour is so restricted by reason of the eight-hour day. If we could possibly get eight hours' work for eight hours' pay, it would probably be less of a trouble than it is. I think that, in the future, and the not distant future, we shall see a disposition on the other side to assist us in this very complex matter." Mr. R. H. Whitelegg, Chief Mechanical Engineer, Glasgow and South Western Railway, proposed "The Technical Press," as referred to elsewhere, to which Sir Alexander Richardson replied.

The Importance of the Ordinary Goods Engine.

DR. HELE-SHAW then proposed "The Institution of Locomotive Engineers." The Chairman, in the course of his reply, said: "There is a tendency, of course, to specialise; you have the locomotive which is designed for specially heavy traffic; you have the locomotive which has got to operate in a waterless country; you have the locomotive that has to go round curves and up mountains and all special kinds like these; some for very quick, short passenger traffic, which will direct our attention in the future, no doubt, to electricity, internal-combustion and other engines. Well, let us not forget that we owe the life of the English railways to a simpler, more ordinary creature, and that is the good old-fashioned six-wheels-coupled locomotive, that has done yeoman's work in the past, and I believe, gentlemen, will do yeoman's work in the future, and I beg to suggest that we, as locomotive engineers, should direct our attention to simplifying and cheapening the reproducing in enormous quantities of the general locomotive that can go anywhere and do anything. At the present time we devote our attention to what I might call 'the fireworks of the profession.' I have always been, as an ordinary person, interested in the rather more ordinary machine, and I should suggest that attention should be brought back to this useful instrument, the old-fashioned, six-wheels-coupled locomotive. . . . Gentlemen, I thank Dr. Hele-Shaw very much indeed for the way in which he proposed this toast. I thank him for his presence because it shows the recognition of the Mechanical Engineers of the value and importance of this Society,

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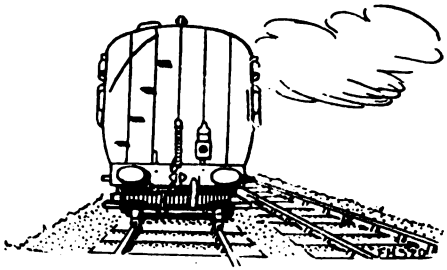
and I think we cannot close without recording the fact that it is under the secretaryship of Mr. Burtt that we have raised ourselves from practically none to 1,300 members. Not only is London taking a great part in this Institution, but Scotland and Yorkshire also take a prominent part.

Railways and Road Transport.

In a statement in support of the North Western and Midland Railway group claim to road rights, in regard to which Parliamentary powers are being sought, Mr. Arthur Watson, General Manager, London and North Western Railway, recently remarked that the turnover from rail to road was virtually a revolution in transport. There were 16,700 heavy motor vehicles on the roads in 1913 and the number of licensed goods motors last year was approximately 120,000. A fair annual mileage for a 5-ton lorry is 12,000 miles, of which half may be assumed to be with a useful load, in other words, each goods motor runs 30,000 ton-miles a year. Each of them pays an annual license fee of £30, which works out at less than a farthing a ton-mile and each of them may damage a road to the tune of 6s. a mile. The ratepayer foots the bill, nor must one forget that the railways are very substantial contributors to local rates. Last year, the principal British companies paid in local taxation, £9,608,483, or almost double what they contributed in 1913. That is to say, while they themselves are denied road rights they are compelled to subsidise rivals to whom last year alone 6,000,000 tons of goods were diverted from the railways. The explanation, of course, is that railways were young and road motors not yet born, when the basis of local taxation was framed, and for that reason we are hopeful that Parliament will now adjust matters by granting road rights to the North Western and Midland group.

"Underground" Developments.

At a meeting of the Underground Electric Railways Company of London, Limited, on March 9, Lord Ashfield indicated that the proposed extensions and new connections associated with the London Electric, Central London, and City and South London Railways, together with the modernisation of the last mentioned line, are likely to be put in hand very shortly. It will be remembered, as already explained in the Railway Magazine, that application has been made under the Trade Facilities Act, 1921, for State assistance, these being undertakings essential in the interests of Metropolitan transport, and of a class which would enable the unemployment problem to be eased materially. The proposals placed before the Advisory Committee under the Act, aimed at securing a Government guarantee as to principal and interest upon a capital sum not exceeding £5,000,000, to be expended upon the reconstruction to a larger size and re-equipment of the City and South London Railway, the construction of connecting lines at Camden Town, between that railway and the Hampstead section of the London Electric Railway, and an extension of the latter from Golders Green to Edgware. A few days later it was stated in Parliament that the desired guarantee has been granted, and the work will now be put in hand.



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MR. R. BELL, C.B.E., Assistant Goods Manager, North Eastern Railway, has been appointed Assistant General Manager. He was educated at Edinburgh University and at St. John's College, Cambridge, joining the North Eastern Railway in 1898 in the Chief Goods Manager's office at York. Two years later he was transferred to the Hartlepools, where he obtained a wide experience in dealing with goods and associated traffic. In 1907 he returned to headquarters, and after holding various responsible positions, became Assistant Goods Manager in 1914.

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MR. ALEX. WILSON, O.B.E., the Assistant General Manager, North Eastern Railway, has been appointed Chief Goods Manager, which position was previously held by Mr. R. L. Wedgwood, C.M.G., C.B., now General Manager. Mr. Wilson began his railway career in the Goods Department of the Caledonian Railway, but in 1889 became Secretary of the Scarborough and Whitby Railway. On the absorption of that line by the North Eastern Railway in April, 1898, he was appointed an assistant in the General Manager's office, under Sir George Gibb. In 1914, in addition to his other duties, he was made Secretary of the Hull Joint Dock Committee. In January, 1920, Mr. Wilson became Assistant General Manager.

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MR. A. BROWN, who has now become Assistant Goods Manager of the North Eastern Railway, entered the service in 1886, as a clerk at Seamer, and after various positions in the traffic and accountant's departments, left the North Eastern in 1899 to become Secretary to the General Manager of the Cambrian Railways. Two years later he returned to York, where he was in charge of important sections of work in the General Manager's Office for eight years. In 1909, Mr. Brown was appointed District Goods Agent at Hull, became Assistant District Goods Manager in 1910, and took charge of the Leeds district in 1913. Mr. Brown is a member of the West Riding Conference and has also represented the North Eastern Railway at many important meetings at the Railway Clearing House.

MR. R. BELL, C.B.E.,
Assistant General Manager,
North Eastern Railway.

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MR. KENELM KERR, O.B.E., who has been appointed Passenger Manager of the North Eastern Railway, entered the service in 1912. Educated at Merchant Taylor's School and Trinity College, Cambridge, he entered the Civil Service in 1904. In 1910, Mr. Kerr became Principal Private Secretary to the Postmaster-General, and in 1912 was appointed Assistant to General Manager, North Eastern Railway, for staff and labour matters, and Secretary (company's side) of the North Eastern Railway Conciliation Conference. Between 1919 and 1921, Mr. Kerr served on various London Committees concerned in negotiating the national settlement, and is a member of the Negotiating Sub-Committee of General Managers, which, since the conclusion of the main national settlement, has been charged with

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MR. ALEX. WILSON, O.B.E.
Chief Goods Manager,
North Eastern Railway.

negotiations with unions. He was also a member of the Central Wages Board as originally constituted, and is a member of the Central Wages Board as reconstituted under the Railways Act.

* * *

MR. ANDREW BAIN has retired from the chairmanship of the Great North of Scotland Railway, and has been succeeded by Mr. Alex. Duffus, Advocate, Aberdeen. Mr. Bain was first elected to the board of directors in December, 1899, and he became Deputy-Chairman in 1906, and Chairman in 1919. He always has taken a deep interest in all matters affecting the welfare of the shareholders, and of the staff, and although he has given up his place as chairman he is retaining a seat on the board.

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SIR GUY GRANET, who has been elected Chairman of the Midland Railway, on the retirement of Mr. Charles Booth from that position, vacated the post of General Manager at the end of 1918, and joined the board of directors. Educated at Rugby and at

MR. A. BROWN
Assistant Goods Manager,
North Eastern Railway.

MR. KENELM KERR, O.B.E.,
Passenger Manager,
North Eastern Railway.

Oxford, he was called to the Bar in 1893. He became secretary to the Railway Companies' Association in 1900, and in 1905, when 38 years of age, entered the Midland Railway service as Assistant General Manager. In July, 1906, he became General Manager, and was knighted on the occasion of the Coronation of King George V. Sir Guy was a conspicuous figure on behalf of the railway companies during the railway strike of 1911, and after the outbreak of war in 1914 was closely engaged in national interests. During 1918 he visited the United States of America on behalf of the British Government in connection with food and transport problems. Mr. Charles Booth, the retiring Chairman, in his speech at the recent annual

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meeting of the company, after intimating his intention to resign, said: "It gives me great pleasure to announce that the board have chosen Sir Guy Granet as their new Chairman, and I am confident that the shareholders will agree that no better selection could have been made. Sir Guy's experience as a recent and most successful General Manager of the company will stand the shareholders in good stead in these difficult times, and they may look forward to the future with the fullest confidence in his guidance."

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We record with regret the death of Mr. Henry M'Adoo, Manager of the Cavan and Leitrim Railway, who was over 70 years of age. A County Monaghan man, about 42 years ago he was acting as relief clerk and travelling auditor on the north-western division of the Great Northern Railway (Ireland), with his headquarters at Enniskillen. He was afterwards appointed assistant stationmaster at Omagh, and later stationmaster and goods agent at Dundalk, Barrack Street. Then he took up a position as storekeeper on the Waterford and Limerick Railway, and after a few years in that capacity, he transferred to be assistant manager of the Cavan and Leitrim Railway. Mr. M'Adoo has been manager of that line for 20 years, and last year was chairman of the traffic officers of the Irish railways.

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Recent railway obituary includes Mr. John Rawson, who retired from the post of Mineral Manager of the Midland Railway at the end of 1914. He entered the service in 1864 as a Goods Clerk at Kirkstall Forge, and was subsequently Goods Clerk at Wisbech and Loughborough, Station Agent at Hitchin, Stationmaster at Rotherham (1873), Goods Manager's District Inspector and Canvasser for the Peterborough district (1876), Chief of the Ledger Collectors' Department at Birmingham (1879), Chief of the Accounts Department in London (1882), Chief Canvasser of the Goods Managers' Department, Derby, in succession to Mr. R. A. Warren (1891), Chief London (City) representative in succession to Mr. Joseph Heaton at the Aldersgate Street office, with charge of all the canvassing arrangements, &c., and also charge of the Castle Street, Falcon and Borough depôts (1900); succeeding Mr. Joseph Shaw as Mineral Manager in January, 1902. Mr. Rawson died at the age of 72 years.

* * *

In the course of his address to the shareholders of the Great Western Railway, Viscount Churchill, Chairman, referring to the appointment of Mr. Felix J. C. Pole, to succeed Mr. Aldington, said: "Our confidence in him is being more than justified by the able manner in which he is filling the position in the difficult times through which we are now passing. Mr. Pole has the advantage of youth on his side, and we hope he may look forward to a long and successful occupation of the increasingly important position of General Manager of this great company." Referring also to the retirement of Mr. G. J. Churchward, Viscount Churchill stated that "It is impossible to speak too highly of Mr. Churchward's services to the company. His reputation as a mechanical engineer is so well known—it is, indeed, world-wide—that it needs no tribute at my hands. In his management of our great establishment at Swindon and our other depôts, and in his development of the magnificent locomotives which it is our good fortune to possess to-day, he has placed us in a position second to none in this most essential department of railway working."

* * *

At a recent "London Underground Railways Efficiency" meeting, Mr. H. E. Blain, C.B.E., Assistant Managing Director, occupied the chair, and before inviting Mr. Harley H. Dalrymple Hay, M.Inst.C.E., Consulting Engineer, London Electric Railway, to read his paper on "Some Facts about the Construction of the London Tube Railways," he distributed diplomas and monetary awards to winners of the Stations Competition for the six months ending November, 1921. These awards were given in recognition of courtesy and general conduct of staff, lift and booking office service, and tidy and cleanly appearance of station premises, &c. The amount awarded each six months was £120, the winning station on each of the various lines getting £20. Of that sum 20 per cent. went to each stationmaster, 10 per cent. to each station foreman, and the balance was divided equally amongst the rest of the traffic staff. The prize stations concerned were as follows:—District Railway: Mansion House (Stationmasters Davies and Ettery); Bakerloo Line: Waterloo Group (Stationmasters Sewell and Hall); Piccadilly Line: Finsbury Park Group (Stationmasters Oliver and Mitchell); Hampstead Line: Highgate (Stationmasters Welling and Gumsley); Central London Railway: Bank Group (Stationmasters Poyner and Hammond); City and South London Railway: Bank (Stationmasters Horton and Kitching).

* * *

The second annual dinner of the London District Traffic Superintendent's Office, South Eastern and Chatham Railway, was held at Anderton's Hotel, Fleet Street, on St.

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Valentine's Day. Mr. E. J. Missenden, the District Superintendent, who presided over the gathering, was supported by Mr. H. E. C. Wheeler, O.B.E., Assistant Superintendent of the Line, Messrs. R. Richards, and J. C. Dann, M.B.E., Assistant District Superintendents, London District, Mr. J. C. Taylor, of Messrs. McCorquodale & Co., Limited, Mr. W. Martin, Chief Clerk of the London District and Mr. E. Card, Station Superintendent, Cannon Street. A most enjoyable evening was spent.

* * *

OF the various railway social functions that occur in London year by year, the Great Northern Railway Literary Society's annual smoking concert is always to the forefront in excellence. This year, the thirty-first of such annual gatherings was no exception to the rule, and under the genial chairmanship of Mr. Oliver R. H. Bury, a director and formerly General Manager of the Great Northern Railway, everything went as merrily as the proverbial marriage bell. The music was good, the artistes were in good form, and everyone appeared in just the right humour—the cares of railway life were laid aside, and the spirit of goodfellowship was everywhere in evidence. Mr. H. Jude, the chairman, and the other members of the Concert Committee, had arranged a capital programme. The artistes included Miss Dorothy Greene, Miss Doris Smerdon, Mr. Harry Dearth, Mr. Arthur Sandford, A.R.A.M., Miss Dorrie Courtney, Mr. Frank Powell, Miss Betty Barclay, and Mr. George Glover, Miss Violet Stevens and Mr. Jack Rickards, Mr. Fred Gibson; accompanist, Mr. Frederick Arthur; at the organ, Mr. Reginald Goss Custard. Quite a large number of leading railway officers were present, not only from the Great Northern, but also from other companies, both English and Scottish. Mr. Oliver Bury, addressing the audience from the platform delivered a very happy and appropriate speech in which he touched lightly on the passing changes in the British railway world, and the different attitude adopted nowadays by Parliament towards railway amalgamations. Mr. Bury made some pertinent remarks concerning the "diehard" character of Great Northern Railway locomotives, illustrating his points by references to the famous single-wheel engines designed by Patrick Stirling, the wonderful "Atlantics" of Mr. Ivatt, and the present-day monsters for which Mr. Gresley is responsible. Electric traction, continued Mr. Bury, was coming upon them very rapidly, but he thought the steam locomotive would last his lifetime, although perhaps some of those present would live to tell their children that they saw the last steam locomotive leave King's Cross.

THE Royal Wedding special on February 28, which left Paddington at 4.15 p.m., was drawn by Great Western 4-6-0 Engine No. 4046 *Princess Mary*. Mr. R. H. Nicholls, Superintendent of the Line, accompanied by Chief Inspector W. Thomas, was in charge of the train, of which the driver was Robert Wiggins, and the fireman A. Bentham. The guard was Tom Willie, the regular guard of the Cornish Riviera express.

* * *

A VALUABLE presentation has been made by his fellow-stationmasters between London and Verney Junction, and by the station staff at Rickmansworth (Metropolitan and Great Central Joint) to Mr. J. C. Springthorpe who retired at the end of 1921 after over 44 years' service. Mr. W. Holt, traffic manager of the Metropolitan Railway was in the chair, supported by Mr. Parsons, of the Great Central Railway, and about 50 subscribers to the testimonial.

* * *

IN the recently-issued fifth annual report of the London "Safety First" Council, the following remarks concerning "Safety First" and Railways will be found:—

The fact that, during 1920, 991 persons were killed and 25,933 were injured on the railways of the United Kingdom, as compared with 932 and 23,983, respectively, in the preceding year, emphasises the vital necessity of the education in 'Safety First' principles of railway travellers and railwaymen. A very large percentage of these casualties were undoubtedly preventable, and this contention would appear to be borne out in the Report of the Chief Inspecting Officer of Railways, wherein it is stated that 95·9 per cent. of 4,597 accidents to servants of Railway Companies were either of an accidental character or caused by want of caution on the part of the injured, and that improvement can only be obtained by educating the men in personal carefulness and generally extending the Safety movement among employees. The same remarks are doubtless equally applicable to the greater proportion of the injuries sustained by railway travellers. A majority of the railway companies operating in the London area actively support the Council and have granted valuable space for the display of bulletins. Two pictorial posters addressed to Railway travellers have been specially prepared and 15,000 copies issued for exhibition. Of a total of 18 Meritorious Service Awards granted by the Council, five have gone to railway servants for conspicuous gallantry in preventing accidents. Another 'Safety First' essay competition for the children of Railway employees was held during the year and

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attracted entrants from all parts of the area within a radius of 20 miles of Charing Cross. Added interest was given to the competition in that several General Managers personally presented the awards to those of the children of their employees who gained prizes. Another feature of this competition was the valuable assistance rendered by the National Union of Railwaymen and the Railway Clerks' Association in the circulation, free of expense to the Council, of large quantities of publicity matter.

* * *

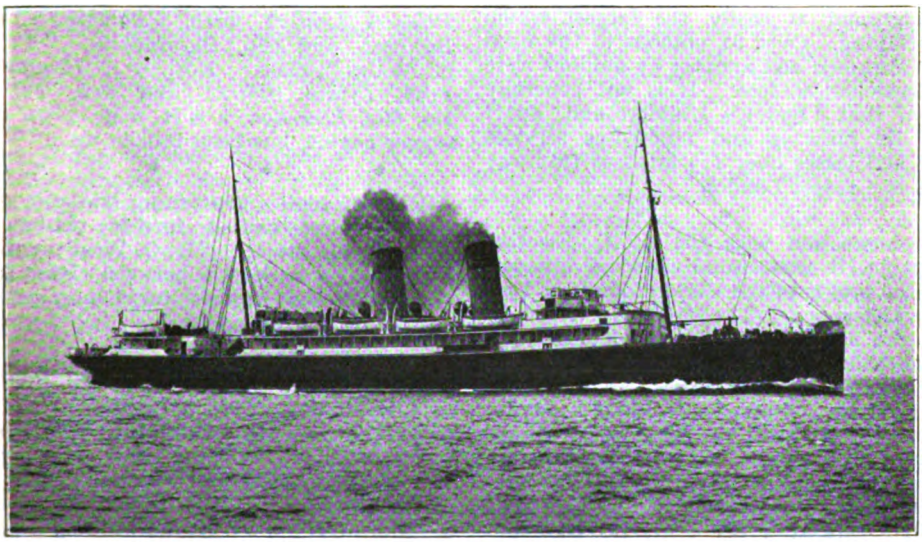
MESSRS. SIEMENS BROTHERS AND CO., LIMITED, send leaflets describing (*a*) the Ferreira and Insell "One Lever Route Signalling" system, and (*b*) the Siemens Mercury Contact Treadle. Copies can be had by responsible applicants from the firm's Railway Signalling Department, at Caxton House, Westminster, London, S.W.1.

* * *

THE Railway Rates Tribunal and the Rates Advisory Committee have now moved from Gwydyr House, Whitehall, London, S.W.1, to 2, Clement's Inn, Strand, London, W.C.2. The jurisdiction of these bodies is set out in the Railways Act, 1921. The Rates Advisory Committee is now holding a public inquiry in regard to the classification of merchandise for the purpose of Railway Rates, and is hearing the objections which were lodged in the early part of last year. The Railway Rates Tribunal will, at a later date, fix the standard charges to be attached to the classification determined by the Rates Advisory Committee, and has also an immediate jurisdiction in regard to the Railway Rates now in operation.

* * *

MR. G. A. HICKS, A.C.G.I., A.M.Inst.C.E., Chief Engineer, Burma Railways, gave an interesting lecture on "The Burma Railways," at a recent meeting of the Permanent Way Institution. Mr. Hicks received his technical training under Dr. W. C. Unwin, at the Central Technical College, South Kensington, between 1896 and 1899, and obtained the diploma of Associate, City and Guild's Institute. From 1899 to 1903 he was engaged as an Assistant Engineer on the Contractor's staff in connection with Folkestone Harbour and Dover Harbour (Admiralty Pier extension). He went out to Burma as an assistant engineer in 1903 and became Chief Engineer in April, 1921.



LONDON & NORTH WESTERN RAILWAY CROSS-CHANNEL STEAMSHIP "HIBERNIA."

* * *

THE London and North Western Railway's Cross-Channel four new steamships are now all in service. As RAILWAY MAGAZINE readers are aware, the *Anglia* and *Hibernia* were the first to be delivered, but recently the *Cambria* and the *Scotia* have been put into service. All four vessels are exactly alike in appearance, but the one illustrated on this page is the *Hibernia*.

* * *

ALL-STEEL coaches for the Great Indian Peninsula Railway and all-steel hopper wagons for iron ore traffic for the Bengal-

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Nagpur Railway are now being built at the Nottingham Carriage and Wagon Works by Cammell Laird & Co., Limited, where a variety of other important railway rolling-stock orders have recently been executed. The Nottingham factory was built in 1915 to meet war requirements. It was erected and managed by Cammell Laird & Co., Limited, who, after the armistice, purchased the factory from the Government with the object of equipping it as a railway carriage and wagon works.

* * *

THE report just issued for the year's working of the London Underground Electric Railway, which includes the three tramway companies associated with it, reveals the astounding figure of 1,293,500,000 passengers carried during the year 1921. London's Underground is easily the largest traffic undertaking. Over 81 millions of the total were workmen and another 57 millions were season-ticket holders. It is not generally known that London's Underground, apart from its railways and motor-bus services owns and leases over 123 miles of tramway track in Greater London.

* * *

IN connection with the L.C.C. Election campaign, it was stated in some quarters that the profits of the Underground for 1921 were £2,650,000. The figures referred to were the net income of these undertakings before deducting interest, rentals and other fixed charges and reserves. The actual return on the Ordinary Stocks of the Company for 1921 was less than 4 per cent., and if all Stocks are taken into consideration including Debenture, Guaranteed and Preference Stocks, the return for the year averages out at 4 per cent. (to be exact 4·08 per cent.).

* * *

WITH reference to a paragraph on page 219, March RAILWAY MAGAZINE, concerning the Pullman Car football specials on the Caledonian Railway, Mr. W. A. Millar points out that on the first occasion, February 4, it consisted of six cars, namely *Maid of Morven*, *Lass o' Gowrie*, *Mary Beaton*, *Mary Seaton*, *Mary Carmichael* and *Mary Hamilton*, with a London and North Western Railway bogie first brake in front. On February 25, on the occasion of the Irish International Rugby match a similar train was run consisting of all the above mentioned cars with the addition of *Flora Macdonald* on the down trip only, and *Duchess of Gordon* on the up train only. The same first brake was in front, and the engines were 4-4-0's No. 892 train engine, and 772 (rebuilt) pilot. Every seat in the train was occupied, and time was well maintained on both journeys. "I am sure," continues Mr. Millar, "both the Caledonian Railway and the Pullman Car Company are to be congratulated on the success of these trains. They should do much to popularise, between the two cities, the parlour car service regularly operated."

* * *

OUR Crewe correspondent reports that the latest 4-6-0 passenger engines ("Prince of Wales" class) to be delivered by Messrs. Beardmore & Co., are: Nos. 491, 493, 551, 554, 492, 518 and 153. In the makers' list these engines are numbered 235, 237, 240–2, 244 and 245 respectively. At Crewe, a new series of 0–8–0 superheater goods engines ("G.2" class) is nearing completion, the numbers being 567–576 inclusive. Further passenger engines are being named as follows: "Claughton" class: Nos. 42, *Princess Louise*; 1019, *Columbus*; 1177, *Bunsen*; and 986, *Buckingham*. "Prince of Wales" class: Nos. 974, *Hampden*; 1178, *Prince Albert*; and 621, *Telford*. No. 869, *Llewellyn*, a 6 ft. 6 in. 2-4-0 passenger engine, has been broken up.

* * * *

RECENT replies concerning Midland 4-2-2 engines have caused further readers to write on the subject. Mr. G. West mentions that No. 670 works between Bath and Gloucester on express turns occasionally piloted by a 2-4-0.

* * *

MR. MALCOLM NIVEN remarks that he recently noted an old "Brittain" outside-cylinder 4-4-0, Caledonian Railway, No. 1181, ready for snow-ploughing, at Oban, running shed. He also observed Nos. 1185 and 1188 on the Oban line. In February he noticed a "McIntosh" 0-6-0 engine working passenger trains on the Callendar and Oban line, where usually the 5ft. 4-6-0's are employed.

* * *

JOINT representations have been made to the Midland Railway Company by the Bath, Bristol, and Gloucester Chambers of Commerce urging provision of refreshment room facilities at Mangotsfield Junction, but the Company have signified their inability to adopt the suggestion.

* * *

AN interesting brochure is being circulated by the London, Brighton and South Coast Railway, written by Bart Kennedy and entitled "The Brighton 'Deck'." The deck, of course, is the well-known marine promenade at Brighton and the writer deals in his usual entertaining and imaginative style with the sights, sounds and emotions there encountered. Train times serving Brighton are included in the booklet.

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KAYE'S railway carriage locks are well-known to the travelling public, but the makers, the firm of Joseph Kaye & Sons, Ltd., Leeds, have other activities and this paragraph is illustrated by an engraving of their new patent motor cycle oil-can. The firm, anticipating a great demand have made preparations accordingly. In the Navy, as well as in the railway service, Kaye's seamless oil-cans have acquired a great reputation, and it may be anticipated that the new motor cycle oil-can will soon be as famous as the firm's other specialities. The price is 18s. per dozen, but a sample will be sent post free for 1s. 9d. The cans are made to the following specification: strong tinplate body with soldered serrated joining fitted with polished brass tubular detachable screwed spout, also pin cap screw on spout end.

* * *

A TRIAL run was recently made of a train drawn by an electric tractor on the section of the Italian State Railways between Turin and Asti, on which the work of electrification has been proceeding for some time past. This is the first part of the section Turin-Ronco to be electrified to complete the whole line from Turin to Genoa, the section from Genoa to Ronco having been electrified for some years past. The trial train which was made up to represent one of the usual express trains on this section weighed (empty) 350 tons, and the tractor was one of the usual type employed by the Italian State Railways, built by the Westinghouse Company, at Vado Ligure in 1913 (group number 331). The trip was eminently successful, the journey from Turin to Asti, a distance of 56 km. (35 miles) being done in 43 min., while the return occupied 42 min. The chief feature of this section is the famous Dusino incline, which starts from near Villafranca Station and terminates just before the station of Villanova d'Asti is reached (in the direction Asti-Turin). It is 10 km. in length; the average gradient being 1 in 100, reaching, however, 1 in 60 for about a kilometre. The highest point touched on the incline is 870 ft. above sea-level. On the trial trip the ascent was made in 8 min.

* * *

MR. J. L. PAYNE, the leading Statistician of Canada, and formerly statistical expert to the Department of Railways and Canals, in the course of a lengthy statement, made recently in Toronto, on the financial position of the railways owned by the Canadian Government, stated that Canada's experiment in the Government control and management of railroads is costing the Dominion approximately $108,000,000 per annum, and the total cost to the Canadian people during the last seven years had been $763,637,214, and there was nothing in sight to indicate that this tremendous burden would be reduced. Last year, according to the official figures, the net deficit on the Government Railways of Canada amounted to $70,331,735 and had the accounts been made up on the same lines as those of privately owned railways the deficit would be shown to be nearly twice that sum. Notwithstanding the lavish outpouring of public money on capital account the annual deficit has increased under Government administration. Assuming that the average deficit amounted to $70,000,000 annually during the six years 1920–25, and charging but 6 per cent. interest, it is estimated that the Government's railway debt account would during that period be swollen to $492,240,589 with total interest charges of $23,900,411. There was no doubt, added Mr. Payne, that a general expectation existed that the railways would be strengthened by being taken over by the Government and that the annual deficit would be reduced. Yet the truth was that the railway situation had grown worse; for the latest available official figures show that the deficit in 1918 amounted to $27,769,577; in 1919 the deficit was $47,993,312 and in 1920 the loss amounted to $70,331,735. Mr. Payne expressed the view that Canada was overbuilt as far as railways were concerned. Regarding the particular systems, he stated that the original agreement of 1881 gave $25,000,000 in cash to the Canadian Pacific Syndicate, through acquired charters and in every other way the Canadian Pacific did not receive from the Public Treasury of Canada $50,000,000 in aid—whereas the moneys advanced to the Canadian Northern Railway amounted to sufficient to construct ten or twelve Canadian Pacifics. Mr. Payne said that the Grand Trunk Pacific Railway should not have been built as the line was not needed; he estimated that the Canadian Government expended $200,000,000 on that railway.

* * *

MANY RAILWAY MAGAZINE readers will be interested to learn that as we go to press we have received a copy of Mr. Williams' new register of all the locomotives now in use on the London and North Western Railway. The book consists of 96 pages and is published at 3s. 6d. net. Copies may be obtained from the RAILWAY MAGAZINE offices by post at 3s. 8d.

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MR. JAMES A. CAMPBELL, the Secretary of the Great Central Railway, in view of his forthcoming marriage was, on March 10, at the General Offices, Marylebone, made the recipient of a gift from his colleagues, which took the form of a handsome mahogany cabinet containing cutlery and table silver. Before asking Sir Sam Fay to make the presentation, Mr. J. Rostern, C.B.E., Chief Goods Manager, stated that Mr. O. S. Holt, the late Secretary, Mr. T. C. Higgins, the late Mineral Manager, and other absent officers had associated themselves with the presentation and sent their good wishes and congratulations to Mr. Campbell. Sir Sam Fay conveyed to Mr. Campbell the hearty good wishes and congratulations of his brother officers, and remarked upon the unique event, inasmuch as this was the only time within the recollection of anyone present that the officers had had occasion to meet together to extend to one of their number felicitations on his marriage, and in making the presentation in token of their regard and esteem he read the inscription upon the cabinet, which was as follows :—

Presented to
James A. Campbell, Esq.,
Secretary,
Great Central Railway,
by his brother Officers, on the occasion of his marriage,
14th March, 1922.

In reply, Mr. Campbell spoke in appropriate terms, and conveyed his deep sense of appreciation of the thought and goodwill of his brother officers. Mr. Campbell's staff in London and Manchester also marked the occasion by presenting to him a silver salver.

* * *

MUCH criticism has appeared in the newspapers and elsewhere concerning the Bill before Parliament in connection with road transport by railway companies. The railways are ready, not only to meet such criticism by assurances, but, where necessary, by amendments of the Bill. To this end the London and North Western Railway has published a memorandum dealing with the criticism, which is mainly concerned with the safeguards provided against any misuse by the railway companies of the powers to be conferred upon them. The memorandum deals fully with the question of rates, the safeguards for existing road transport interests, the non-promotion of unprofitable services, and, further, thoroughly defines the position to-day. In conclusion the company explains that the assurances and proposed amendments of the Bill set out in the memorandum merely represent the intention which the railway companies by the clauses of the Bill desire to put into effect, and which, on several occasions, they have endeavoured to make clear. It is hoped that the definite pledges contained in this memorandum will remove any apprehension as to the completeness of the safeguards outlined in the Bill.

Photo.] GREAT CENTRAL RAILWAY. [*W. H. C. Kelland.*

3.20 p.m. London-Manchester express, near North Harrow.
Four-cylinder 4-6-0 locomotive, "Earl Haig."

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Photo] [*Topical*

THE "VICTORY ARCH" WAR MEMORIAL,
Waterloo Station, London & South Western Railway.

Photograph reproduced was taken when H.M. QUEEN MARY *formally opened the New Station, March* 21, 1922.

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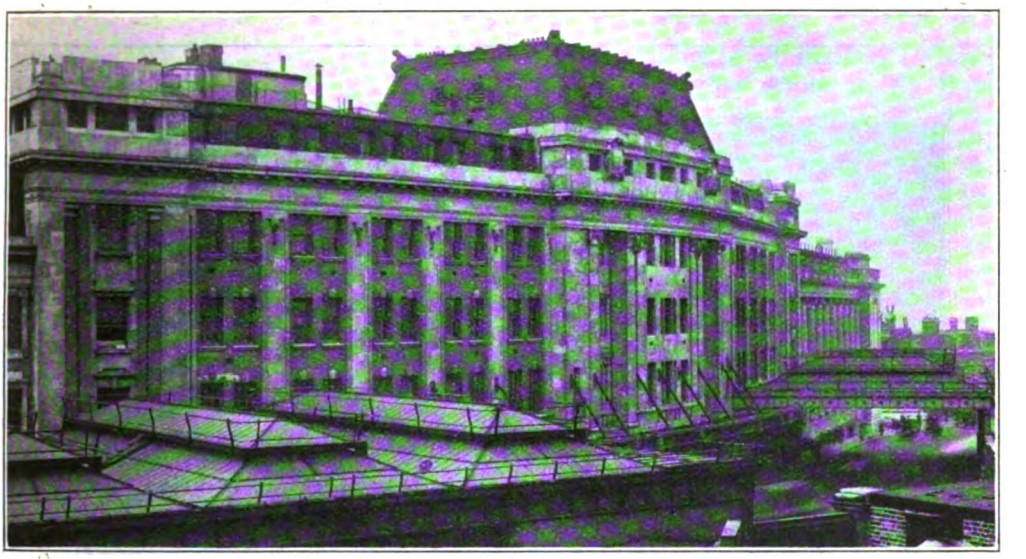

Photo.] GENERAL VIEW OF STATION BUILDINGS. [*Topical.*
Showing roofs over main cab yards and, on right, approach from York Road.

The Largest Railway Terminus in Great Britain.

WATERLOO: LONDON AND SOUTH WESTERN RAILWAY.

By J. F. GAIRNS.

RANKING first in the list of "Largest Railway Stations in Great Britain," by virtue of its 21 platforms, Waterloo now takes its place also as the most modern and up-to-date, due to the fact that within the last 12 years or so it has been almost entirely rebuilt and reconstructed, so much so, that few traces remain of the Waterloo which existed when the twentieth century opened. The "great transformation" goes, however, much beyond the station itself, for the huge reconstruction which has now reached completion, and was formally opened by Her Majesty the Queen, on March 21, includes also the provision of head office quarters which rank among the finest provided for the administration of the business of a railway company, while the new premises comprise features which, as will be seen, include many points of interest, not the least of which is the magnificent "Victory Arch" incorporated into the architectural design in memory of London and South Western Railway employees who gave their lives in the great war.

The first Waterloo Station was opened in 1848, when the London and South Western Railway was extended from Nine Elms. It had but three platforms, traces of which existed until comparatively recently. There were then four approach lines, and it was considered at the time that accommodation would be amply sufficient "for present and future needs!" In 1862, Windsor line platforms were added; and in 1879 the "South" station was built. The latter became known as "Cyprus," in view of international negotiations which made the island a British protectorate at that time. In 1885, the "North" station was added on the Windsor side, and for this the name

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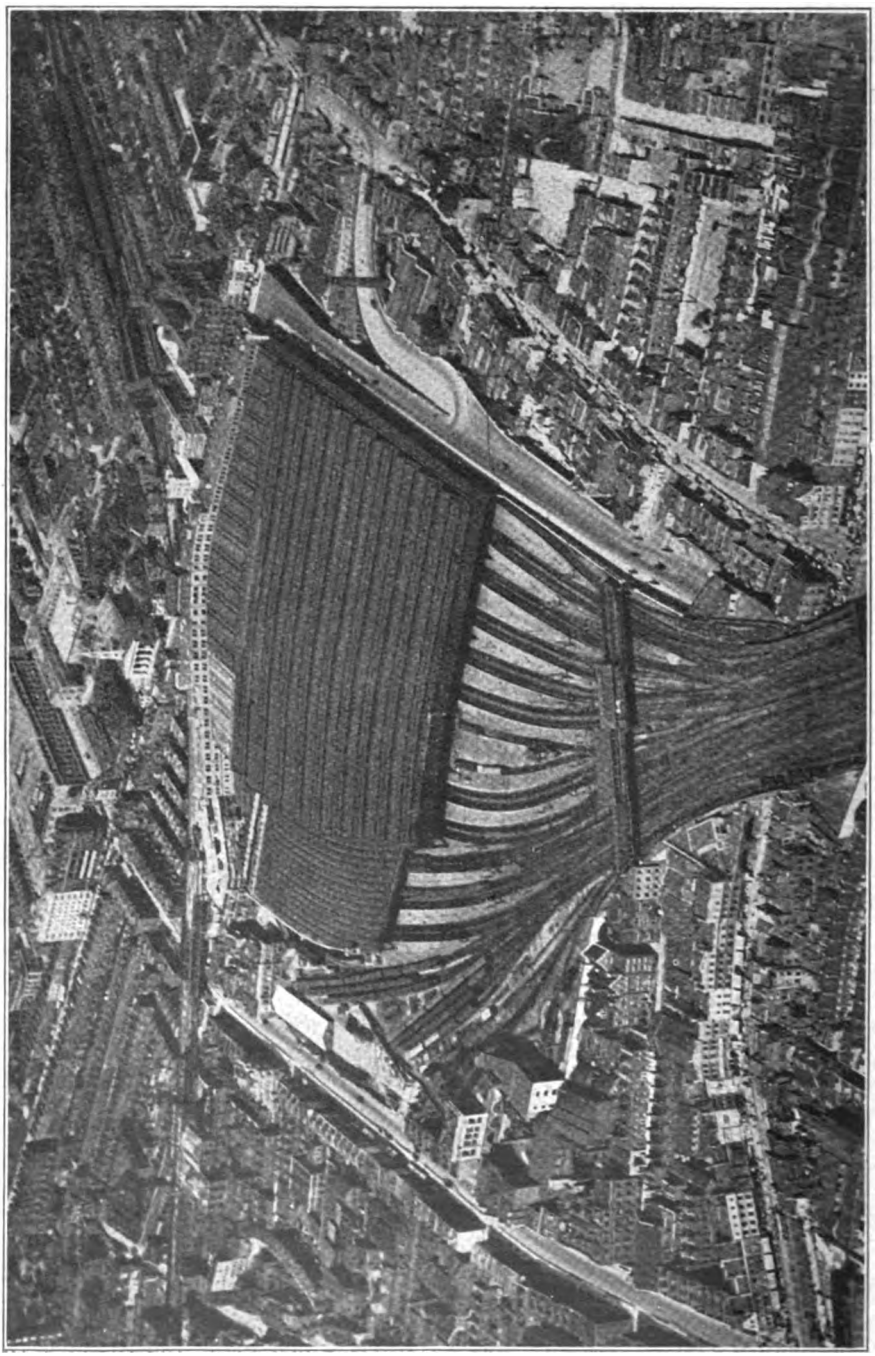

AERIAL VIEW OF THE NEW WATERLOO STATION.

[*Photo.*] [*Central Aerophoto Co.*

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" Khartoum " was adopted, because of occurrences in Egypt.

As thus extended there were 18 platforms, but the station as a whole was far from being conveniently arranged, and to passengers it was generally regarded as " bewildering." The chief difficulty was the location of the " South " station as a kind of annexe, connected by a covered passage-way. The lay-out did, however, indicate the piece-meal manner in which the station had been built up, and the use of the names " Central," " South " and " North " (or " Windsor ") for the respective sections did not tend to clarify matters, besides which station offices were much scattered.

Reconstruction has been carried out under Parliamentary powers obtained in 1899 and 1900, but it was not until about 1910 that there were many signs of the great transformation which the next ten years would witness. Much of the preliminary work was associated with the formation of new road approaches, new foundation works, &c., but by 1912 the " South " station had entirely disappeared, and in its place were six wide platforms, served from a spacious circulating area faced by a section of the new offices and station premises. Work had also been commenced on the " Central " station, including the removal of the engine shed and turntable, which, until then, existed at the back of the principal main line departure platform.

Adjacent to this line, which had a platform on both sides, was No. 4, which, in conjunction with No. 5 and a middle road, gave access to a junction with the South Eastern and Chatham Railway " Waterloo Junction " station adjoining. This connection was at one time used for through London and North Western trains from Euston to Cannon Street, via the West London and West London Extension Railways. This was soon reduced to one between Willesden Junction and Waterloo, which ran until comparatively recent years, and only for a very short period was the connecting line mentioned used for regular traffic. But it was, until its closure, largely used for interchanging vehicles between the respective systems, and occasionally special trains, including those conveying Royalty, were worked that way. The connection was single track, and a bridge was provided at the end of Nos. 4 and 5 platforms across it, so that passengers could pass on platform level, except when the bridge was opened for the passage of interchange vehicles. A footbridge serving the main line platforms provided, however, the principal passenger access, the main circulating area being beyond No. 5 platform, and this footbridge was, oftentimes, the scene of much animation. The roof of the main line section was of somewhat antiquated type, and the station as a whole suggested very noticeably that it had been built according to the ideas of a past generation. Part of the " Central " station included, indeed, the original premises, while the adjoining engine shed, in the main station itself, obviously dated back to early days, as did, also, the " Crow's Nest " signal cabin under the roof over No. 4 platform and originally installed to control traffic while vehicles were being shunted by means of a series of turntables.

It will, therefore, be seen that the Waterloo which has now disappeared, but which existed well into the present century, possessed greater historic than utilitarian interest, and the principal redeeming feature was the signalling, which, at that time placed Waterloo in the first rank among the great terminal stations in that respect. This signalling had been chiefly installed in 1892, when the present and most famous " A " box was brought into use. The first was built in 1867, and had a Stevens & Sons " hook " locking frame containing 47 levers; the second, built in 1874, was equipped by Saxby & Farmer, and had 109 levers; the third was built round its predecessor, 35 levers being added by Stevens & Sons (20 further levers added in 1880 and 65 in 1885); while the fourth represented the largest undertaking carried out by Stevens & Sons. At first there were 236 levers, but this number was increased to 248 before the present reconstruction was taken in hand, and the total is now 266, with six electric slides in connection with route-indicating signals referred to later, applying to the Up Main Relief Home Signal. The signalling as it existed in 1905 was admirably described in these pages by Mr. W. E. Edwards (*see* RAILWAY MAGAZINE, January, 1905). It has now been modified in several respects by the

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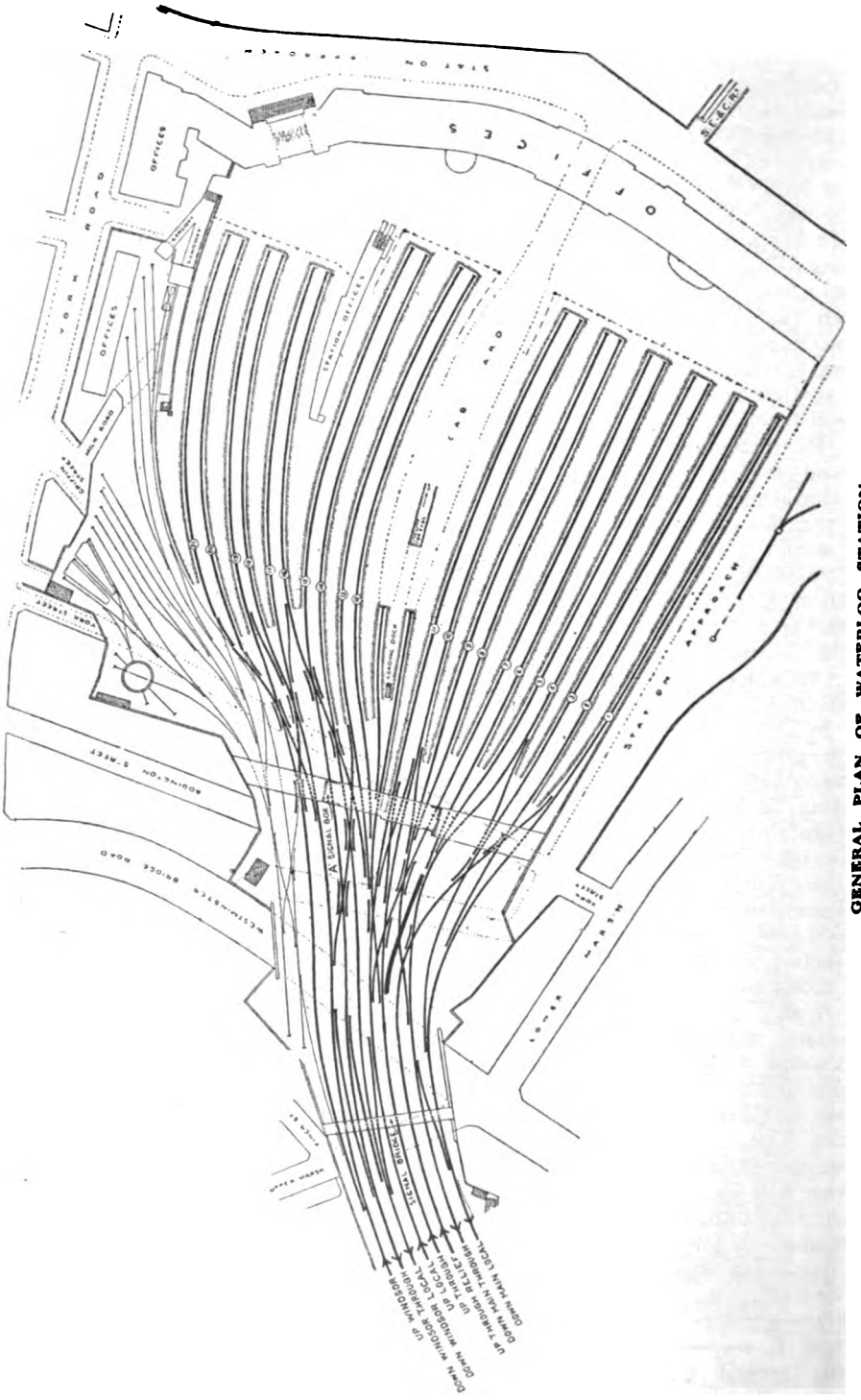

GENERAL PLAN OF WATERLOO STATION.

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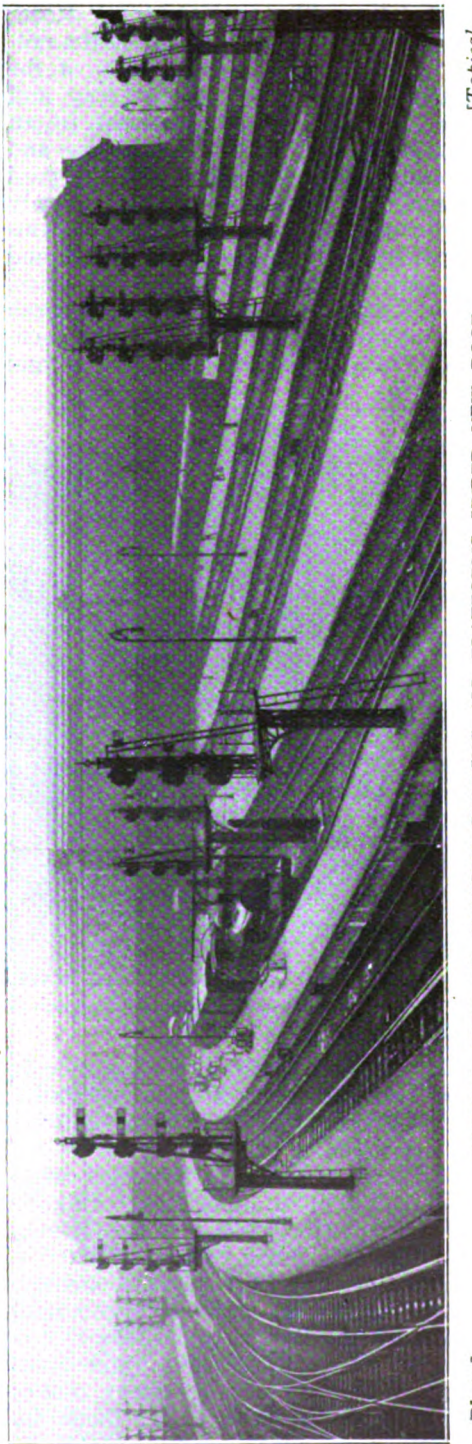
Engineer's Department of the London and South Western Railway, but still retains many of its special features, notably the use of "gear" levers and "setting" levers, the former, in conjunction with "simplex" apparatus, enabling 72 levers to operate either of three distinct signal connections under the control of the gear levers, each of which has three working positions. This feature, utilised to meet conditions where a route once set was available for arrival, departure or shunting train movements, but entailed different signals for each, has been largely retained. It not only enables the number of levers to be reduced, but lessens the distances to be traversed by signalmen, a very material gain in so large a box. It is, therefore, equivalent to one with many more levers as ordinarily fitted.

The 1892 equipment included the provision of a "sky line" series of elevated bracket signals erected above the box. These were mainly of a directing character, and only a few now remain, most of the others having been taken down in view of the installation of route-indicating signals for up trains, of bracket posts for the respective platforms, and various developments in the signalling, which need not be considered in detail at this stage.

Dealing now with the station as reconstructed, the main features are the great "concourse" or circulating area which extends virtually right across the station; the wide platforms of which Nos. 1–15 are all covered by a high glazed steel roofing of uniform character throughout; and the splendid range of station and headquarters office buildings which bound the "concourse."

Speaking generally, the station is above road level, and public access is provided in three directions for vehicular traffic, and in a fourth for foot passengers only, together with tube railway connections. The approach road from York Road gives the best impression of the new office buildings, as it rises on an incline past the "Victory" Arch, which gives direct entrance to the Windsor side of the station, thence to the main exit for cabs from the cab road between platforms 11 and 12, and to the covered cab yard in front of the main booking hall. Stairways enable foot-passengers to reach the main booking-hall from Waterloo Road.



[*Topical.* *Photo.*]

GENERAL VIEW OF STATION SHOWING ALL PLATFORMS UNDER NEW ROOF.

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A second approach road has been constructed from Westminster Bridge Road, passing under the whole width of the railway just beyond the outer ends of the platforms by a curved covered way, and rising alongside No. 1 platform to an entrance at that end of the concourse and extending round to the covered cab yard outside the main booking hall already mentioned. A spur road connects this approach road with the Lower Marsh, and thus with Waterloo Road from the south. Below the main cab yard is a low level cab yard adjacent to the Waterloo Road entrance, and this has separate entrance and exit ways, while a subway for empty cabs from York Road passes under the station and rises directly to the cab yard between platforms Nos. 11 and 12.

ENTRANCE FROM WATERLOO ROAD, OLD STATION.
Showing connecting bridge to South Eastern and Chatham Railway.

Two further routes for passenger access exist, both of great importance. Adjacent to No. 21 platform is a new hall opening from the concourse, from which two inclines lead, one to a subway extending across the station and which communicates with the Waterloo and City electric line by which the London and South Western Railway obtains direct connection with the City area at the Bank, and the other to the booking hall of the Bakerloo Railway, whose trains place the London and South Western Railway in direct communication with the entire "Underground" railway system. During the war a Free Buffet for Soldiers and Sailors was placed in this subway, and the site is commemorated by a plate fixed to the wall inscribed, "On this site, 1915–20, the Waterloo Free Buffet for Soldiers and Sailors fed over eight million men from British Imperial and Allied Forces. Worked and supported entirely by voluntary effort." The "Bakerloo" booking hall also connects directly with the subway mentioned, and as this has stairways leading to each platform of the main station, it affords a convenient means of distributing passengers without affecting the main concourse above at all. This subway is connected about midway with the Waterloo and City station below, in one case by inclines and at another point by stairways which lead to an escalator shaft, singularly spacious, and embellished by oil paintings supplied by an Insurance Company, which gives convenient connection with the concourse above, between platforms 15 and 16.

Waterloo is thus well supplied with means of public access from all directions, including two main thoroughfares—Waterloo and Westminster Bridge Roads

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—on which frequent tramway services are available; from York Road, on several L.G.O.C. routes; from Waterloo Junction station adjoining; and via the Waterloo and City and London Electric Railways, while the subway affords material relief to the main concourse for the distribution of passengers. The subway also has a direct connection from the main concourse by stairways opposite Nos. 7–10 platforms, adjacent to which an old Bodmin and Wadebridge railway carriage, standing on original permanent-way and mounted on a pedestal, is a conspicuous feature.

Dealing now with the main concourse, lofty section, open on one side to the cab yard and with doorways to the concourse. The booking office proper is oval in plan, half serving the booking hall (windows J, K, L, M and N), and half extending into the concourse (windows O, P, Q, R, S and T). In the latter section is a theatre ticket office.

Continuing, but on the concourse side only, the ground floor of the range of buildings provides, in order: ladies' first-class waiting room with entrance from booking hall; general waiting room; ladies' third-class waiting room; dining and tea room (with lift connection with a main dining hall on the first floor);

OPENING BRIDGE CONNECTING NOS. 4 AND 5 PLATFORMS, OLD STATION.

the station offices may be briefly considered. Opposite No. 1 platform is a large cloak room. This is connected by lift with large storage accommodation in three ranges of arches below. Next is a gentlemen's court, with washing accommodation, dressing rooms, and a hairdressing saloon. A doorway gives entrance to the offices of the Superintendent of the Line and the Goods Department, &c., above. A large luggage hall with label cabinets, weighbridge, &c., comes next, this communicating with the concourse on one side, and with the outside cab yard on the other, while it has also doorways into the main booking hall adjoining. The latter is a spacious and restaurant; exit archway for cabs; trunk telephone and telegraph office; luggage passage and weighbridge; buffet; another booking office extending into the concourse, and with windows (A, B, C, D, E, F, G, H, I) on that side only, and used mainly for issue of suburban and Windsor line tickets; new buffet and tea rooms; ladies' first and third-class waiting rooms (the former fitted with dressing-rooms, bathrooms, &c.); general waiting room; gentlemen's court; Windsor side cloak-room; entrance from York Road and Approach Road via the "Victory" Arch; entrance to old general offices; and hall leading to London Electric and Waterloo and City Railways.

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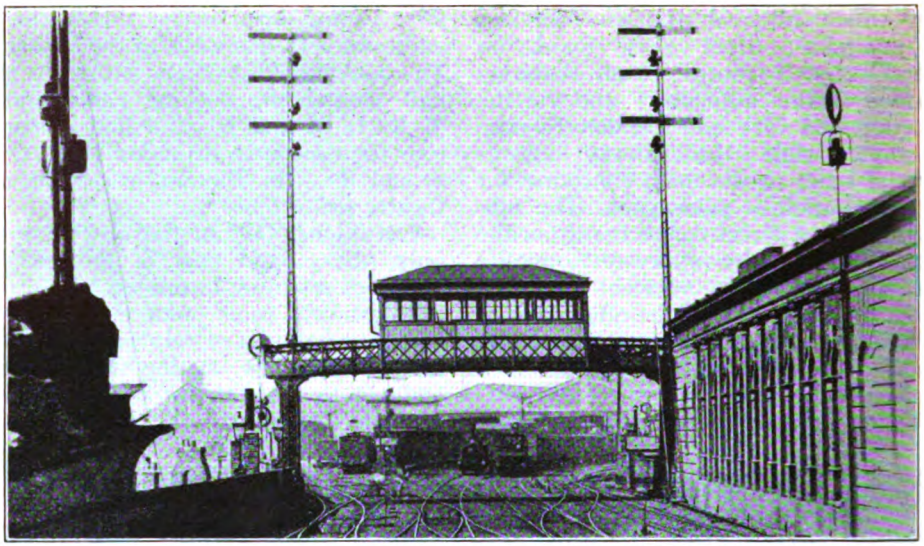

THE FIRST "A" BOX AT WATERLOO, 1867.

On the concourse adjacent to the platform entrances may be noted a tobacco stall between Nos. 2 and 3; bookstall between Nos. 4 and 5; train departure indicator between Nos. 6 and 7; inquiry office between Nos. 8 and 9; public telephone boxes between Nos. 10 and 11, and tobacco, fruit, and other stalls, with a small bookstall, on the Windsor side. The main bookstall is in the centre of the concourse. Train departure indicators are placed in several positions about the concourse. Illuminated time-table stands may also be noted. The whole of the concourse, together with the platforms, particularly those from 1 to 15, are noteworthy because of their spaciousness, the splendid roof lighting and suggestion of airiness, while the completeness and convenience of the refreshment departments (under the direction of Messrs. Spiers & Pond, Limited), the numerous booking windows, all with unhindered access, the extensive cloakroom accommodation, and the waiting rooms and other passenger facilities justify special emphasis.

It may be mentioned that the office building which now extends the whole width of the station is equally complete. Heating is by hot water, lighting electric, and ventilation ducts and conduits for telephone wires are provided beneath the floors of all corridors. The various refreshment departments are to a great extent divided off from the rest of the building, and these premises are leased to Messrs. Spiers & Pond; but the equipment is essentially modern, including the main kitchens which are on the top floor of the building. On the roof are large ventilating fans, while among special features may be mentioned the telephone and telegraph offices on the top floor, giving telegraphic or telephonic communication between Waterloo and every station on the system, and which are connected with the public telegraph office adjoining the concourse by means of a "pneumatic delivery" plant.

Between platforms 15 and 16, and below the roof, is a further block of buildings, reached on one side by a railed-off pathway, and used for staff purposes. At platform level on this side are the staff pay and time offices; storeroom and quarters for travelling Post Office sorters, G.P.O. men, &c.; police messroom; porters' rooms, &c. Upstairs is a guards' room, and a large dining-room, with its own kitchen premises, for the use of clerks employed about the station and in the general offices. At the concourse end of this building is the escalator to the subway below, while on the other side are the stationmaster's public offices (with his private and clerks' rooms above), and the lost property office, the latter

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having large storage premises below. Besides the main passenger subway there is another below it, used for luggage transfer, and for milk traffic. This has a connection with the lower road on one side of the station and with spacious parcels premises in the arches adjacent, with loading platforms for road parcels vans, so that general parcels and luggage not accompanying passengers can be dealt with apart from the work of the station above.

Dealing now with the station from the traffic working point of view, the following are the lengths of the respective platforms :—

No. 1, 696 ft. ; No. 2, 695 ft. ; No. 3, 683 ft. ; No. 4, 685 ft. ; No. 5, 720 ft. ; No. 6, 723 ft. ; No. 7, 728 ft. ; No. 8, 735 ft. ; No. 9, 756 ft. ; No. 10, 765 ft. ; No. 11, 860 ft. ; two short loading docks, respectively 160 and 166 ft. in length ; No. 12, 828 ft. ; No. 13, 838 ft. ; No. 14, 830 ft. ; No. 15, 610 ft. ; No. 16, 550 ft. ; No. 17, 587 ft. ; No. 18, 597 ft. ; No. 19, 596 ft. ; No. 20, 615 ft. ; No. 21, 531 ft.

At the back of No. 21 is a dock line, which can be used for short trains, and which is 234 ft. long. Nos. 1–6 and 16–21 are equipped with conductor rails for the use of electric trains.

Traffic is usually allocated as follows : No. 1, Hampton Court, electric ; No. 3, Shepperton, electric ; No. 4, Kingston "roundabout," electric ; (During the evening pressure this is usually varied thus : No. 3, Hampton Court ; No. 4, Kingston "roundabout" ; No. 6, Shepperton). Nos. 5 and 6, race trains, and various specials; No. 7, Bournemouth and West of England ; No. 8, Portsmouth ; Nos. 9 and 10, stopping and miscellaneous trains on various country routes. No. 11, the longest, is used for the principal boat trains to Southampton. No. 12 is generally used for loading mails, and for parcels and other non-passenger trains, though it is also available as an arrival platform. Nos. 13, 14 and 15 are the usual main line arrival platforms. No. 16 is used for Wimbledon (via Southfields) and Shepperton (via Richmond) electric trains ; Nos. 17 and 18 for Hounslow electric loop trains respectively via Richmond and via Brentford ; No. 19 for Kingston "roundabout" electric trains. Nos. 20 and 21 are reserved as a rule for Windsor and Reading steam trains.

The following are the numbers of trains usually dealt with at Waterloo daily.

	ELECTRIC.		
Arrivals	Main line side		175
	Windsor side		176
Departures	Main line		176
	Windsor		180
	STEAM.		
Arrivals	Main line side		129
	Windsor		38
Departure	Main line side		120
	Windsor side		39
			1,033

"A" BOX AS IT IS TO-DAY.

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MR. J. S. JERRETT.
Stationmaster.

There are, in addition, 52 empty train arrivals and 65 empty departures, and together with regular parcels and other non-passenger trains the full total is 1,159 trains in and out in the course of 24 hours. All the year round there are also numerous special trains to and from Southampton, frequently 10 per day. It is not unusual for the departure from, or arrival at, Southampton of a big liner to require from four to six specials, while smaller vessels are continually involving additional trains. Favourite race meetings, many of which are served by the London and South Western Railway, also call for specials in considerable numbers. During last summer, reliefs, excursions, &c., brought the total number of trains dealt with at Waterloo to 1,370, a total which will probably be considerably exceeded this year.

The staff associated with Waterloo Station, irrespective of the large numbers employed in the general offices, totals about 450 under Mr. Jerrett, station-master, including signalmen, inspectors, ticket-collectors, porters, &c. Under Mr. Jerrett are three assistant station-masters, Messrs. W. C. Edwards, P. G. Collins, and C. Richards. His chief clerk is Mr. W. C. Wiltshire. The booking office staff is under Mr. Hills, and the parcels staff under Mr. Newsam. All the refreshment room and restaurant staffs are employees of Messrs. Spiers & Pond, Limited.

At this stage it may be mentioned that everything found on the line is sent to the Waterloo lost property office, amounting to between 40,000 and 50,000 items annually, ranging from umbrellas and walking sticks to false teeth, workmen's tools, perambulators and bicycles, over-coats, cloaks, &c. A considerable pro-portion is reclaimed, but there is always a large residue disposed of at the auction sales held every six months. On the occasion of the writer's visit a curious instance of forgetfulness came to notice. Quite casually the label on a rain-coat was turned up: "Found on radiator, L.P.O." Apparently the owner had come to make enquiries for something else, and, presumably overjoyed at re-covering whatever he had lost, had gone off leaving his coat on the radiator near by. In the main line cloak room about 295,000 items are dealt with annually, on the Windsor line cloak room about 41,000. According to the latest statistics available, about 186,000 passengers use Waterloo Station daily.

Space will not permit of the signalling and traffic arrangements being reviewed in detail, but this aspect may be briefly covered. Waterloo is served by eight running lines, respectively known as follows, with the platforms which they serve: Down Main Local (1–10); Down Main Through (4–10); Up Main Relief (1–6); Up Main Through (4–16); Up Main Local (7–16); Down Windsor Local (7–16); Down Windsor Through (13–21); Up Windsor (13–21). There are, however, interchange facilities at "B" box which render it possible to route a train to or from almost any part of the station, and not infrequently, in order to clear an incoming train, expresses are sent out via the Down Windsor Local line and crossed to the Down Main Through at "B" box.

Outside the station on the down side are several sidings (largely used for storing electric trains during the quieter hours) and engine lines, with turntable. Adjacent is the private station of the London Necropolis Company. Beyond

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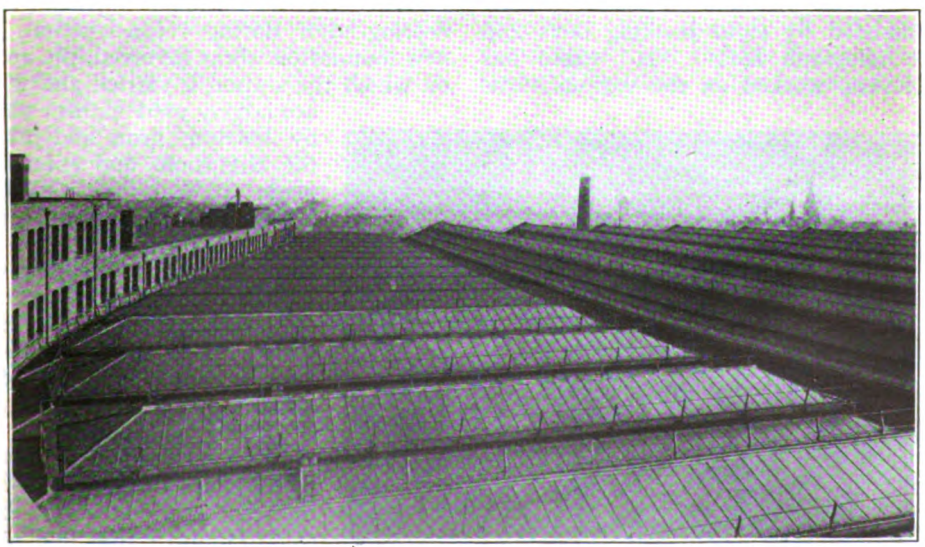
No. 21 platform are also several sidings and engine lines.

At present track circuits are provided on nearly all the running lines and in a short time the whole of the running lines will be completely protected by track circuits, those in the station being in two sections, so that short trains, particularly unit sections of electric trains, can be stabled at the buffer stop ends, and ordinary trains worked in and out of the outer portions. This also safeguards trains or vehicles which may be left for unloading luggage or for other purposes near the buffer stops. All platforms have hydraulic buffer stops of modern design. To safeguard engines which have proceeded to a running line for backing on to trains and to protect shunting movements, electric fouling bars and treadles are freely provided within the maze of connections and crossovers, under and near "A" box. but these bars are being dispensed with, and the track circuits utilized in their place.

Departures are controlled by bracket posts in pairs for the lines on either side of each platform, with starting arms for each down road to which access is given, and shunting and wrong-road arms. Several platforms have, about half way along their length, intermediate light signals, which, when the track circuit between this light signal and the starting signal is clear, acts as a repeater of the starting signals. The advanced starting signals, with the first distants encountered, are on either the bridge which spans the lines or on the cantilever beyond "A" box, as the track complications of the terminal area come to an end.

Up trains have distants to "B" box at "C" cabin. "B" box has two signal bridges, one with up home signals governing the interchange connections already mentioned, with fixed distants (direct routes only) to "A" box. The down bridge of signals, also covering interchange signals, and direct road distants to "C" box, is provided also with a series of fixed wrong road limit signals, to cover shunting movements from the terminus with long trains. Approaching "A" box a great simplification has been realised by the use of route-indicating signals. A cantilever carries that for the Up Windsor (to platforms 13–21), and that for the Up Main Local (to platforms 7–16), while the signal bridge carries route indicators for the Up Main Through (to platforms 4–16), and Up Main Relief (to platforms 1–6) lines. Those of the elevated signals which still remain above "A" box are retained mainly for the information of men working in the yard and of platform staff, as they are covered for running purposes by other signals.



GLAZED ROOF OVER CONCOURSE.

Roof over platforms to the right, upper part of portion of office building to left.

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"A" box has the levers in two rows between which the men work, and in three sections. One deals with the work of the main line station, another with the Windsor side, while the third section governs movements which require one section to control the box. There are now 266 levers in this box, including the six gear leavers which render them equivalent to 410. In addition, there are six electric slides for the route-indicating signals, applying to the Up Main Relief Line Home Signal, the other route indicators are controlled by electric switches connected to the signal levers themselves. Electric indicators to meet every operation without requiring the men to observe traffic working outside the box, and illuminated electric diagrams showing red or green disc lights as trains pass over or clear the various track-circuited sections or electric fouling bars are provided. About 24,000 lever movements are made in the course of each 24 hours.

Below the floor of the box is the interlocking mechanism and the leadaway connecting the points and signals with their respective levers. Accommodation for the hundreds of track, point detector, and repeater relays and other electric appliances is provided in the upper and lower relay rooms. Sixteen men are attached to this box, six on duty 6 a.m. to 2 p.m., six from 2 p.m. to 10 p.m., and four between 10 p.m. and 6 a.m. They are assisted by eight booking boys and three telegraph lads. "B" cabin has 100 levers, worked on the various turns by three, three, and two men; and "C" has a 30-lever frame, operated by two, two, and one men. The sidings and engine lines outside the station on the south side are controlled by a ground frame.

MR. A. W. SZLUMPER, C.B.E.,
Chief Engineer, London & South Western Railway.

One might deal with many other aspects, such as the engineering difficulties surmounted by the railway company's engineering staff during reconstruction, the new foundation works involved, the arches on which the station is carried and which are largely used as beer vaults by bottling firms and others, the alterations and extensions made to Waterloo and City premises below, and the repair shops for the latter which are carried in a kind of sunk well owing to the fact that they lie partially below the river water level, while the design and equipment of the office buildings, and of the premises occupied by Messrs. Spiers & Pond would justify an article many times the length of this. Sufficient has, however, been said to indicate that the "New Waterloo" is now entitled to rank not only as the "Largest

INTERIOR OF TEA-ROOM.

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Photo.] MR. R. D. HAWES. [*Elliott & Fry.*
New Works Assistant to Chief Engineer, London & South Western Railway.

Station in Great Britain," but also, by virtue of its reconstruction on essentially modern lines, to rank as the finest terminus in the Kingdom. It only requires a splendid hotel to complete its accommodation, and that may come in time.

Meanwhile, it has been the writer's pleasure to deal with the station as it now emerges, virtually completed, from the "ashes" of its predecessor, as a credit and lasting monument to the enterprise of the directors, the capability of chief officers and staff, and the good work of the contractors. The London and South Western Railway has for long ranked as one of the leading and most prosperous of our great railways, and in the "New Waterloo" it has a terminus and chief offices befitting its traffic and commercial importance.

The work has been designed and carried out under the direction of the Chief Engineers of the company, viz.: the late Mr. J. W. Jacomb Hood, who died early in 1914, and since then by Mr. Alfred W. Szlumper, C.B.E., M.Inst.C.E. The resident engineer throughout has been Mr. R. D. Hawes, A.M.Inst.C.E., Assistant Engineer for New Works.

For special assistance, and facilities for the collection of material enabling this article to be written, the writer is indebted, first, to Sir Herbert Walker, K.C.B., General Manager; secondly, to Mr. A. W. Szlumper, C.B.E., Chief Engineer, and his staff, of which Mr. R. D. Hawes, New Works Assistant, must be specially mentioned; thirdly, to Mr. W. J. Thorrowgood, Signal and Telegraph Superintendent, in regard to signalling matters; and, fourthly, to Mr. Jerrett, Stationmaster, who has enabled much of the traffic and statistical information to be presented.

The "New Waterloo" was formally opened on Tuesday afternoon, March 21, by Her Majesty Queen Mary. Until late on the evening of the day before King George had intended to perform the ceremony, but acting under medical advice in consequence of the development of a chill, His Majesty was compelled to remain indoors. The Queen drove to Waterloo from Buckingham Palace, reaching the York Road entrance just before three o'clock, and a rousing cheer was raised as the Royal car passed under an arch of evergreen and bunting into the railway approach. The Queen alighted at a crimson dais erected in front of the memorial archway, and was received by Brig.-General H. W. Drummond, Chairman, and Sir William Portal, Deputy-Chairman, of the London & South

INTERIOR OF NEW BUFFET.

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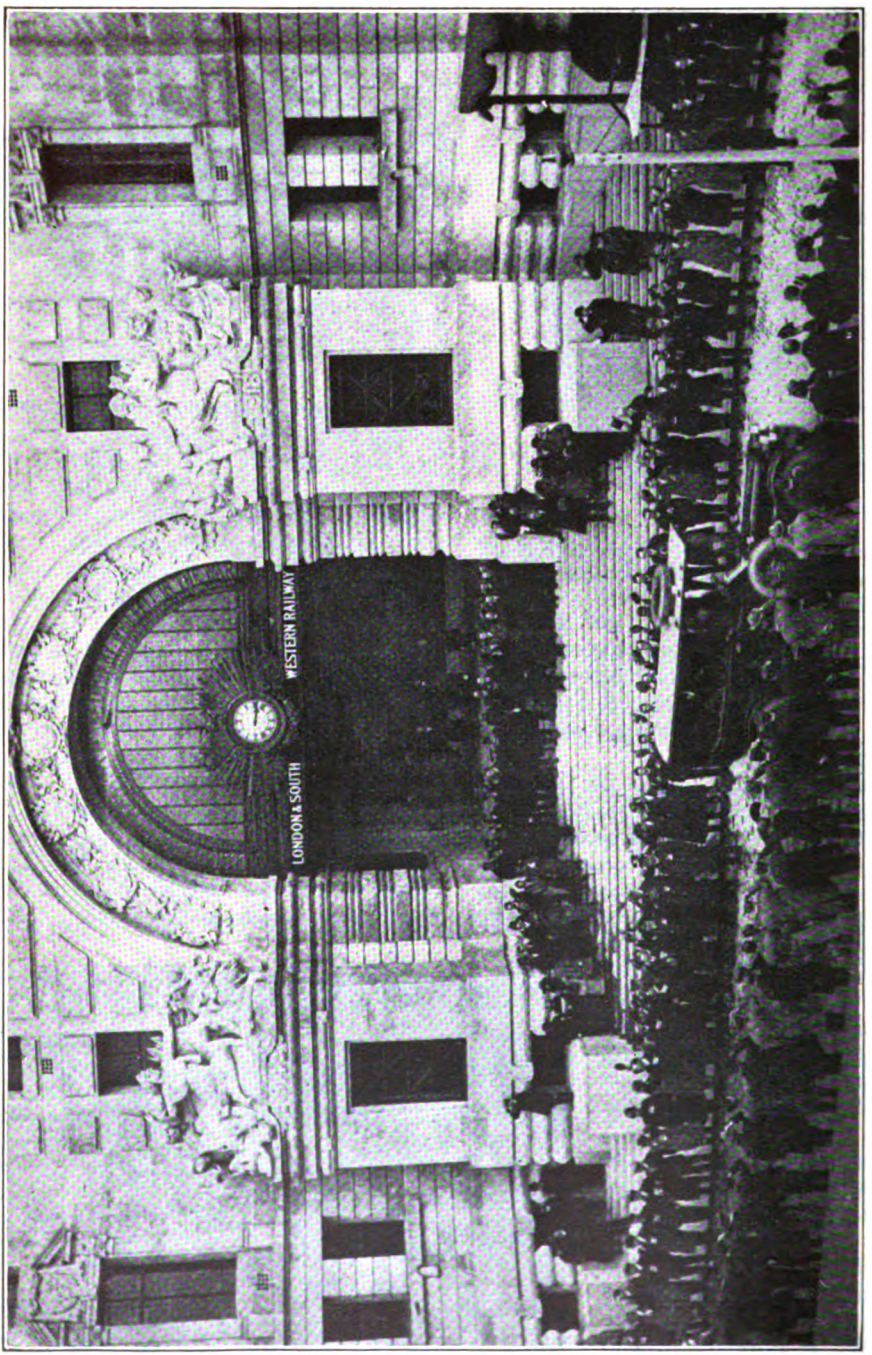

Photo.] H.M. QUEEN MARY LEAVING WATERLOO AFTER THE ROYAL OPENING CEREMONY. [*Topical.*

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Western Railway. After receiving a bouquet of red roses from Miss Drummond, daughter of the Chairman, Her Majesty inspected a guard of honour of nearly 100 of the company's employees who had earned distinctions in the war. Major H. F. Burt, M.C., R.F.A., of the solicitor's office, Waterloo, was in command, and the detachment included three R.N.R. captains of the company's steamers who had come through all the risks of conducting the cross-Channel passage in war time. In the course of the inspection the Queen made appreciative comments on the services rendered by the members of the guard of honour.

Then were presented by the Chairman (Brig.-General H. W. Drummond) to Her Majesty :—

Directors : Sir Evelyn Cecil, M.P., Colonel the Hon. Sir Harry Crichton, A.D.C., Viscount Pirrie, K.P., Lord Clinton, Mr. Robert Holland-Martin and Sir Charles Owens.

Officers : Sir Herbert A. Walker (General Manager), Mr. A. W. Szlumper (Chief Engineer) and Mr. George F. West (Superintendent of the Line).

Contractors : Mr. Dudley Bartlett (representing Perry & Co., Limited, contractors for the building work) and Sir Guy Wrightson (representing contractors for the iron and steel work).

Engineering Assistants : Mr. R. D. Hawes (Assistant for Waterloo Station Works) and Mr. J. R. Scott (Architect for Waterloo Station Works).

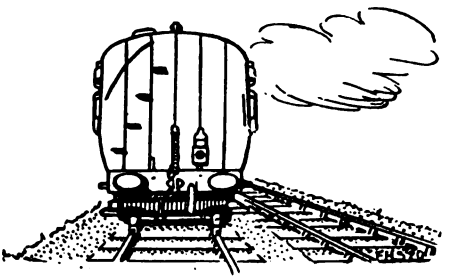
Wives of Directors and General Manager : Mrs. Gertrude Drummond, the Hon. Lady Cecil, Lady Emma Crichton, Mrs. Holland-Martin, Lady Owens and Lady Walker.

Among other guests were :—

Sir Derek Keppel (Master of the King's Household), Viscount Churchill (Chairman, Great Western Railway), Lord Claud Hamilton (Chairman, Great Eastern Railway), Lord Ashfield (Chairman, " Underground Railways "), Sir Wm. Hart Dyke (Chairman, London, Chatham & Dover Railway), Sir Sam Fay (General Manager, Great Central Railway), Sir Henry Thornton (General Manager, Great Eastern Railway), Sir William Forbes (General Manager, London, Brighton & South Coast Railway), Mr. F. Tatlow (General Manager, Midland Railway), Mr. C. H. Dent (General Manager, Great Northern Railway) and Sir George McLaren Brown (Canadian Pacific Railway).

Accompanied by Brig.-General Drummond, Her Majesty then ascended the steps to the Victory Archway, severing, as she did so, the silken cord which had been drawn across the entrance. In passing through the arch the Queen lingered to examine the bronze mural tablets setting out the names of the 585 London & South Western Railway employees who had given their lives in the war. As she passed through the great " Concourse " giving access to the 21 platforms, she received hearty cheers from the many spectators. The Queen then paid a visit to the brightly-decorated buffet and examined the illuminated Roll of Honour of the London & South Western Railway staff, which was standing on an easel in the corner of the room draped with the Union Jack.

Before leaving the station, Her Majesty expressed her congratulations to Brig.-General Drummond at the success of the opening and the completion of the great undertaking in re-building the mammoth terminus at Waterloo.



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THREE-CYLINDER 4-6-2 LOCOMOTIVE, No. 1470, GREAT NORTHERN RAILWAY.

Mr. H. N. GRESLEY, C.B.E., Chief Mechanical Engineer.

(Full particulars will be given in the June RAILWAY MAGAZINE.*)*

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British Locomotive Practice and Performance.

By CECIL J. ALLEN, A.M.Inst.T., A.I.Loco.E.

Photo.] [*F. E. Mackay.*

NORTH BRITISH RAILWAY.

Up Edinburgh-St. Pancras Express nearing Carlisle.
4-4-2 locomotive, No. 878, "Hazeldean."

FROM the correspondent whose letter was dealt with on page 187 of the March issue, I have received so convincing a reply that I hasten to give it publicity; I am quite ready to admit, indeed, that this letter has somewhat modified my own views on the subject. "In case you like to continue the topic of the 'scope' of your articles," he writes, "I send a few more remarks; after being accused of 'taking fright' I cannot leave it at that! Your position—that your subject is not 'timekeeping' but 'performance'—I admit to be quite tenable; but I suggest that in your articles you do not really hold it. If you dealt only with test performances, such as the historic Maréchal series on the P.L.M. Railway of France, or ordinary runs on which you have good reason to believe that the locomotives are being made to exert the maximum of power that may reasonably be expected in everyday service, you would be acting up to your principle. But you take your examples from a wider area than that (*e.g.*, your down London and North Western Birmingham trips in the March issue), and this at once introduces, *inter alia*, the personal factor of the driver's intentions and methods, which so frequently have to be referred to, in order to explain this or that feature of the work; thus you have indeed frankly, and, I think, quite rightly, included this question of timekeeping within the range of your discussions. In fact, drivers being what they are, some strong, some medium and some mild, I do not see how you can possibly avoid frequent reference to other than purely mechanical or 'locomotive' matters."

"Again—to join issue with you on your main defence—you ask: 'Of what interest is it to the great majority of readers to know that an inefficient driver or an engine out of condition succeeded in losing so many minutes on such-and-such a schedule?' If it is of no interest, why do you mention cases of this kind even so often as you do? But I should rather maintain that it is very interesting indeed, and that because the object of our interest as railway enthusiasts is *typical* locomotive work rather than specially selected and exceptional performances. The latter are most valuable and inspiring, because they set a standard of what is attainable; but surely it is the general level of attainment that is the

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Photo.] **LONDON, BRIGHTON AND SOUTH COAST RAILWAY.** [*A. B. MacLeod.*
8.5 a.m. Express train about to depart from Brighton for London (Victoria).
4-6-4 Tank Engine, No. 327, "Charles C. Macrae."

standard by which 'British Locomotive Performance' should be judged. Further, as I said, it is the standard by which I think you are forced to judge it yourself in your articles, though you pretend not to! Now no one, of course, wants to wade through details of poor runs. But what does seem to me desirable is that if a series of, say, a dozen runs is made, of which one is brilliant, four are quite good, five humdrum, and two definitely poor, there should be a general statement of *all* the results, and not merely of the selected 'best.' Thus, in the above case, I should like full details of the first run and the best points of the next four, together with bare outlines—load, weather conditions, gross and net overall times, and explanation of engine loss, if any—of the remaining seven.

"I lay stress on the driver's share in the result, because that is the most important non-mechanical factor; but at the same time I do not mean to exclude other matters, such as station work (see your articles of February and March, 1922), unnecessary signal checks (December, 1921, and February, 1922), time-table defects (December, 1921), and various other details which are not locomotive details, but yet in the everyday working of express services play a very considerable part. I feel that, what locomotives *can* do in keen and capable hands, it is desirable for the sake of all travellers that they *should* do as often as possible; that your articles help to fix the standard of what can be done in ordinary service; and that when you can introduce a comparison between that standard and average performance in similar circumstances, the comparison is not only interesting in itself, but is likely to be influential (your articles being so widely read as they are) in bringing about improvements where they are needed, and bestowing credit where it is due." My friend's closely-reasoned argument is irresistible. Considerations of space would still forbid me to deal with *all* my runs, even in the extremely abbreviated form that he proposes, but his point of view, which I now find to be shared by other readers, shall not be lost sight of. Indeed, I think he will agree that the way in which the Midland runs described in the last issue were set out—the article was written and complete some weeks before I received his letter—goes a long way to meet the point of view expressed. My worst runs of the series, both up and down, figured in the tables, and the only runs not mentioned were those my friend describes as "humdrum"; that is to say, time-

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keeping runs incorporating no features, either good or bad, that were not fully expressed in the 12 journeys tabulated.

Another letter—amusing, somewhat less temperately worded, and thoroughly characteristic of the writer—reaches me in connection with the same topic. "I have often been on the point of writing to you on the subject of your articles in the RAILWAY MAGAZINE," it opens, "but have hesitated to do so, hoping that abler pens than mine would take up the attack. Others having set the ball rolling, my conscience compels me to come to their support." I have heard it said that the *pen* is mightier than the sword, but my correspondent evidently intends that the *ball* shall be mightier than both in its overwhelming effect on the hapless writer of these articles! "Let me say," he continues, "that I agree most heartily with the reader who complains of the uniform and somewhat monotonous excellence of your 'performance.' Your runs are, in the majority of cases, 'superlative'; the 'comparative' degree gets a show now and again, the 'positive' never." My correspondent falls here into the fatal error of over-stating a good case, to an extent which I leave other readers to judge for themselves. "If in your lengthy mileage of express train journeys about this 'Land for Heroes' your experiences are to be judged on the high merit of the runs that figure in your articles, then all I can say is that you are remarkably lucky. My own experience, in frequent journeyings on the service of a road transport concern, whose name I need not mention, within a 50-mile radius of London, together with one eagerly-anticipated annual return journey to the land of 'Tre, Pol and Pen,' is the opposite."

"Of course I may be biased—in favour of road competition—but that is another matter. Were you to cease gliding about the country in mile-a-minute fliers that are never late"—overstatement again! I only wish it were true—"and try some of the secondary services, you might get caught, as I have been many times. I do not for one moment desire to question the policy of your articles, but I do think they would have an added value if you mixed the bad with the good a little oftener. My point is this. A certain leading railway is given to advertising 'Reliable Transportation.' To anyone using that railway to any extent, the advertisement is lost entirely, for time-keeping on the line in question has of late been so bad, that such a claim is regarded as merely funny. Your articles tell of wonderful achievements in the way of speed, and of expresses reaching their

Photo.] GLASGOW AND SOUTH WESTERN RAILWAY. [*F. E. Mackay.*

Glasgow St. Pancras Express. 4-6-0 locomotive, No. 120.

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Photo.] GREAT EASTERN RAILWAY. [*F. E. Mackay*

Down Yarmouth Express. Superheated 4-4-0 and 4-6-0 locomotives Nos. 1817 and 1519.

destination on the stroke of time. I am not for one moment suggesting that you are guilty of exaggeration, but I do say that much of the value of your writing is lost, as it is so opposed to the everyday experience of many of your readers."

Now here is a clear challenge. I have looked up my records of running over the railway to which my correspondent refers, and find that, since the accelerations of last summer, I have made 24 separate journeys in its trains, covering a total of 4,186 miles. The average lateness of arrival of 13 down journeys was 0·44 min., the latest being 5¼ min., while of 10 up journeys, the latest arrival was 12½ min., and the average lateness 2·20 min. The whole 24 trips therefore were completed, after allowance has been made for the occasions on which we arrived before time, within a mean excess over schedule time of 1·25 or 1¼ min. exactly. If my opinion were asked, I should say that this record—the railway concerned is the Midland—is, under present-day difficulties, an exceptionally fine one, and one that the majority of other British railways would be hard put to it to beat. And when it comes to loss of time due to "locomotive" as opposed to traffic or permanent-way delays, I am bound to add that throughout my experience there has been no railway on which I have experienced so little loss, either as a result of locomotive failures, engines out of condition, or inefficient driving, as on the Midland. During over 13 years' continuous travel, in which the Midland has figured largely, as these columns have borne witness, on one single occasion only has the engine failed of any Midland train in which I have been travelling. That particular run was described in these columns in May, 1911. Consequently I feel compelled to "bless," like Balaam, where my correspondent was evidently hoping to induce me to do the opposite, and consider the claim of the company concerned to provide "Reliable Transportation" as well-founded, so far as my own experience goes.

"I happen to know," the letter proceeds, "with what respect adverse reports in the daily and the technical press are treated, on one railway at least, and how carefully complaints thus appearing are inquired into. Other lines, I take it, are equally anxious to keep a good reputation. Therefore, with your reputation for accuracy and open-mindedness, I am certain that occasional bad reports, published under your name, would do good and tend to bring about improvements in working." I begin to think this must be really true. Since certain rather severe comments as to delays to expresses at Didcot, which appeared in the December

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issue, I have made six journeys through that station at full speed, without the veriest semblance of a check! "Certainly I agree with your critics who plead the cause of the tank engine. I do not agree that the performance of tank engines on ordinary suburban lines is of 'little or no interest,' unless the station-to-station distances are short, as within the Great Northern Railway and Great Eastern Railway in-town areas. The performance of tank engines on long-distance suburban work, the powers of acceleration of various types, and their running on 'non-stop' journeys, would seem to me hardly uninteresting. I wish the time-table were 'an accurate indication of the running' of the —— Railway trains, on which it is my misfortune to travel, day after day."

I fear that my friend is no worse off in the last-mentioned respect than many of us. Between my place of residence and the City there intervene some 13 miles of hilly country, not to mention two important junctions and two other stations famed for the extent of their milk traffic (conveyed per passenger train), where I can plainly see that a large slice of my existence is destined to be spent. The fastest schedule for the distance is 37 min. and the average booking of the "non-stop" business trains is between that and 40 min., but if the round three-quarters of an hour or less sees us safely into town, we have done well. And yet, on this journey, we have at one point frequently exceeded 50 m.p.h., and once touched a level sixty. One of these days, when I am no longer "gliding about the country in mile-a-minute fliers that are never late," I must find space to describe some of these peerless journeys. Meanwhile the enquiring reader, who is not familiar with my home address, may be left to deduce it from the slender clues given.

And now for performance. Rather than delay any longer a series of runs on the accelerated main line trains of the Great Central Railway, I am going to describe them in the present issue, even at the expense of holding over the balance of the Midland journeys whose description was commenced last month.

I will commence with five down journeys on the 3.20 p.m. from Marylebone, which figure in the annexed table, and in order to protect myself in advance from criticism, I would remark that these are *all* the runs I have had on the train in question, without exception, during the last twelvemonth. The first of them has been described already, in the July issue of 1921, and is included merely to show what the "Directors" can do with a really substantial train; it was made, of

Photo.] GREAT CENTRAL RAILWAY. [*F. E. Mackay.*

Leicester, Nottingham and Manchester Express leaving Marylebone.
4–4–2 locomotive, No. 192.

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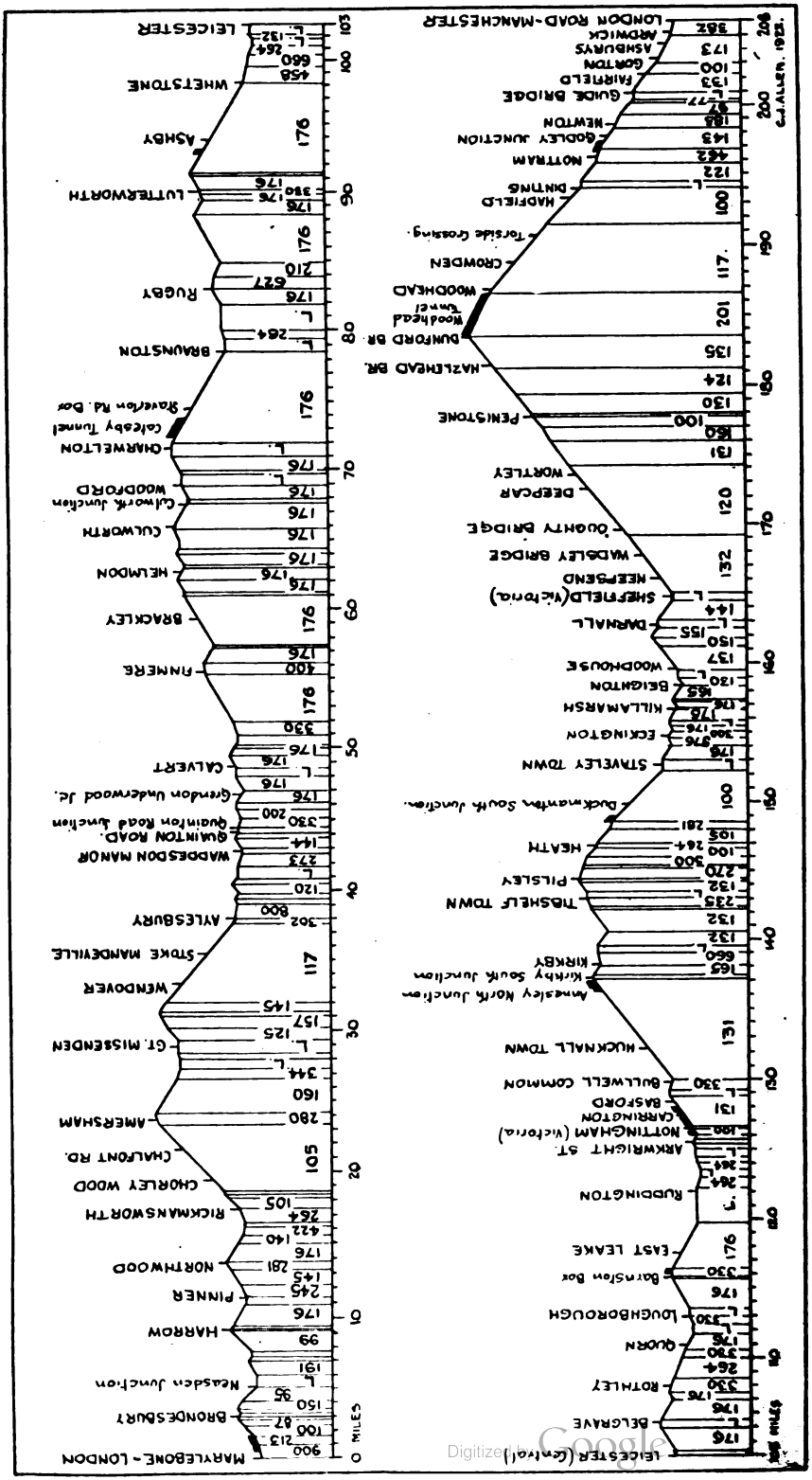

GREAT CENTRAL RAILWAY.

Gradient profile, London (Marylebone) to Manchester (London Road) *via* Aylesbury.

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course, before the accelerations came into force. Since those accelerations the schedule allowance has been 14 min. to Harrow, 46 to Aylesbury, 53 to Quainton Road Junction, 77 to Woodford and 109 to Leicester, an average rate of 63 m.p.h. being therefore demanded over the 58·7 miles from Quainton Road to Leicester. From there to Nottingham the start-to-stop journey of 23·4 miles, with a slow finish, claims 25 min. only, and the exceedingly difficult 38·2 miles on to Sheffield occupy 48 min. These times are further complicated by an exceptionally severe slack through Rickmansworth, three are drawn to exactly the same vertical and horizontal scales. The London and North Western main line has—by comparison—the appearance almost of a level track, and even the steeper gradients of the Great Western Railway northern main line sink into comparative insignificance against the mountainous outline of the Great Central. Of the whole Great Central route to Manchester 15 per cent. is on grades of 1 in 117 or steeper; 21 per cent. south of Sheffield, and 31 per cent. of the whole, is on grades of 1 in 135 or steeper; and no less than 68 per cent. of the journey is over gradients

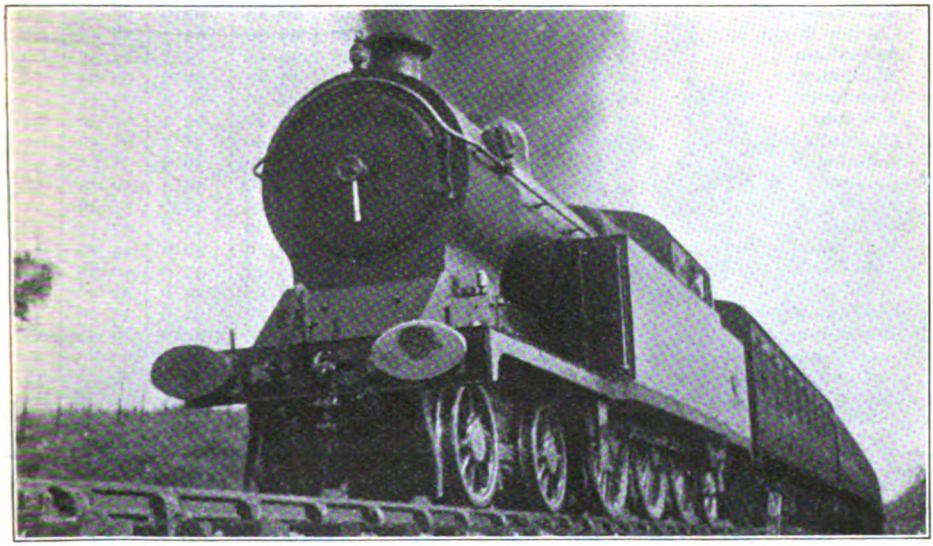

Photo.] GREAT CENTRAL RAILWAY. [*Chas. S. Lake.*

Local train near Amersham.

before commencing the ascent to Amersham, a fairly severe slack over Quainton Road Junction, and some moderation, on account of curves and collieries, in maximum speeds between Nottingham and Sheffield.

It is a task of practical impossibility to attempt to describe in words the grading of the Great Central main line, and I have therefore gone to the trouble of preparing the profile which is reproduced herewith. A study of it brings home once again the extraordinary difficulty of the route traversed. Compare, for example, this profile with those of the two routes from London to Birmingham which appeared on page 113 of the February issue; all of greater steepness than 1 in 202. From Marylebone to Manchester *via* Aylesbury, the "vertical rise" (the sum of heights through which the train is lifted on adverse gradients) reaches the astonishing figure of 2,900 ft., against 2,250 ft. by the Midland and 1,080 ft. by the London and North Western routes respectively, or a shade over 14 ft. per mile average throughout. In these circumstances the maintenance of Great Central schedule times, even allowing that loads are on the light side as compared with those of, say, the North Western, involves very hard locomotive work, and such a feat as that of maintaining an average of over a mile a minute from Amersham to Leicester,

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GREAT CENTRAL RAILWAY.—MARYLEBONE-SHEFFIELD.

Distance.	Engine No.: / Name: / Engine Type: / Tare load (tons): / Full load (tons):	‡510 *Princess Mary.* 4-4-0 296 320	438 *Worsley Taylor.* 4-4-0 221 230	507 *Gerard P. Dewhurst.* 4-4-0 220 230	1166 *Earl Haig.* *4-6-0 221 230	1169 *Lord Faringdon.* *4-6-0 219 230	Distance.	¶506 *Butler Henderson.* 4-4-0 145 155	†431 *Edwin A. Beazley.* 4-4-0 181 190
Miles.		m. s.	m. s.	m. s.	m. s.	m. s.	Miles.	m. s.	m. s.
0·0	Marylebone .. dep.	0 00	0 00	0 00	0 00	0 00	103 1	113 00	111 45
3·0	Brondesbury .. pass	7 00	6 15	6 25	6 25	6 15	100·1	108 15	107 20
5·1	Neasden Jc. .. ,,	9 40	8 40	8 50	9 00	8 40	98·0	105 35	104 55
9·2	Harrow .. .. ,,	14 40	12 50	13 15	13 20	12 30	93·9	101 00	100 45
11·4	Pinner .. .. ,,	17 05	15 10	15 35	15 55	14 40	91·7	98 05	98 05
13·7	Northwood .. ,,	19 50	17 35	18 05	18 30	16 55	89·4	95 45	95 40
17·2	Rickmansworth ,,	23 30	21 05	21 40	22 15	20 15	85·9	91 15	90 45
19·4	Chorley Wood .. ,,	27 10	24 40	25 15	25 30	23 30	83·7	88 45	88 30
23·6	Amersham .. ,,	34 50	31 00	31 35	31 45	30 15	79·5	84 35	84 35
28·8	Missenden .. ,,	40 20	36 05	36 40	36 45	35 15	74·3	79 05	79 05
33·3	Wendover .. ,,	45 10	40 35	41 10	41 15	39 40	69·8	73 55	73 40
38·0	Aylesbury .. ,,	49 05	44 40	45 15	45 35	43 40	65·1	67 50	67 30
44·4	Quainton Rd. Jc. ,,	55 00	51 05	51 50	52 10	50 40	58·7	61 10	60 30
46·8	Grendon Jc. .. ,,	57 45	53 45	54 35	54 55	53 20	56·3	58 15	57 50
48·8	Calvert .. .. ,,	59 45	55 40	56 35	56 50	55 20	54·3	56 25	56 10
54·5	Finmere .. ,,	66 00	61 20	62 40	62 30	61 20	48·6	51 30	51 40
59·3	Brackley .. ,,	71 40	66 20	67 55	67 30	66 30	43·8	47 15	47 30
62·5	Helmdon .. ,,	75 50	70 00	71 45	70 55	70 10	40·6	44 20	44 50
66·1	Culworth .. ,,	79 40	73 35	75 30	74 20	73 45	37·0	40 35	41 30
69·1	Woodford .. ,,	82 35	76 15	78 15	76 50	76 25	34·0	37 30	38 50
71·5	Charwelton .. ,,	85 05	78 35	80 40	79 10	78 40	31·6	34 50	36 20
78·5	Braunston .. ,,	91 15	84 30	86 40	85 25	84 55	24·6	26 35	28 45
83·2	Rugby .. .. ,,	95 10	88 30	90 40	89 40	89 20	19·9	22 25	24 45
90·0	Lutterworth .. ,,	101 45	95 20	97 10	96 20	97 00	13·1	16 20	18 35
93·9	Ashby .. .. ,,	105 40	99 10	101 00	100 10	100 55	9·2	12 00	13 30
98·4	Whetstone .. ,,	109 15	102 55	104 30	103 55	104 35	4·7	6 55	7 20
103·1	Leicester .. arr.	114 00	107 40	109 05	108 55	109 00	0·0	0 00	0 00
0·0	Leicester .. dep.	0 00	0 00	0 00	0 00	0 00	23·4	25 55	26 00
2·3	Belgrave .. pass	5 05	4 15	4 20	4 10	4 15	21·1	23 05	23 25
5·0	Rothley .. ,,	8 25	7 15	7 20	7 05	7 20	18·4	20 05	20 50
9·8	Loughborough ,,	12 50	11 35	11 35	11 30	11 35	13·6	15 10	16 15
12·6	Barnston Box .. ,,	15 40	14 20	14 25	14 30	14 20	10·8	12 25	13 25
19·0	Ruddington .. ,,	21 10	19 35	19 30	20 10	19 50	4·4	6 10	6 25
22·5	Arkwright St. .. ,,	24 20	23 00	22 50	23 30	22 50	0·9	2 10	2 15
		Sigs.	Sigs.						
23·4	Nottingham .. arr.	27 05	26 00	24 50	25 55	24 50	0·0	0 00	0 00
0·0	Nottingham .. dep.	0 00	0 00	0 00	0 00	0 00	38·2	47 30	50 00
1·6	Basford .. .. pass	5 00	4 15	4 20	4 00	4 05	36·6	44 40	47 05
5·8	Hucknall Town ,,	11 40	9 45	9 50	9 30	9 25	32·4	40 30	43 05
10·8	Kirkby S. Jc. .. ,,	20 30	16 05	16 30	16 40	16 20	27·4	35 05	38 00
17·9	Pilsley .. .. ,,	29 30	23 40	24 20	25 10	24 00	20·3	27 15	30 20
20·3	Heath .. .. ,,	32 20	26 15	26 55	28 10	26 25	17·9	24 00	26 30
26·2	Staveley Town .. ,,	37 35	31 50	32 55	34 10	31 40	12·0	16 15	16 50
30·0	Killamarsh .. ,,	41 25	36 00	37 00	37 40	35 15	8·2	12 10	12 20
33·2	Woodhouse .. ,,	45 00	39 35	40 40	41 05	38 40 Sigs.	5·0	8 20	8 30
36·2	Darnall .. ,,	49 15	43 40	45 00	45 05	43 10	2·0	4 35	4 45
38·2	Sheffield .. arr.	52 25	46 20	47 40	47 50	46 15	0·0	0 00	0 00

‡ Rebuilt and superheated 4-4-0 No. 1027 from Leicester.
* Four-cylinder engine.
¶ Four-cylinder 4-6-0 No. 1166, *Earl Haig* to Leicester.
† Two-cylinder 4-6-0 No. 424, *City of Lincoln* to Leicester.

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as did the 4-4-0 engine *Princess Mary* with a 320-ton train—was one of distinct brilliance.

In regard to the profile, I would mention that, for purposes of simplification, as the scale is somewhat small, in one of two cases of constant changes of gradient, I have taken an average for a mile or so, and the very short strips at easier gradients through the stations situated on the middle of steep banks, as, for example, Chorley Wood and Chalfont Road—are omitted for the same reason. The small scale has been deliberately chosen in order that a "bird's-eye" conception of the route may be obtained, this being in my opinion an essential in estimating the relative difficulty of locomotive performance. For timers, I would mention that from London to Quainton Road Junction, mile-posts are all on the down side, the mileage being calculated from Baker Street (Metropolitan); after that they are all found on the up side, and the mileage runs from London Road Station, Manchester. Neasden Junction (box on down side), Quainton Road Junction (down side), and Grendon Underwood Junction (up side), are all important points to record. The novice should also beware that every station from Calvert to Hucknall Town inclusive, with the exception of Arkwright Street, Nottingham Victoria and Carrington only, is built on the island platform principle, with a single platform in the centre of the two roads, often easily missed if one is sitting on the down side of a down train, or the up side of an up train.

At the time of *Princess Mary's* effort, made in Easter week last year, the schedule to Leicester was one of 116 min., entailing an average speed of 54·3 m.p.h., yet the tare load was 61 tons in excess of the maximum allowed to Midland compounds, at almost precisely the same booked speed, over the less difficult route from St. Pancras, which was dealt with last month. The train was absolutely packed, and many were standing after Nottingham. We did not touch more than 57½ m.p.h. after Brondesbury, eased considerably over Neasden Junction, and fell to a shade under 40 at Harrow; touching 59 at Pinner, we dropped to 50 at Northwood; and we did not exceed 62½ before slacking for Rickmansworth. Sustained rate up Chalfont Road bank was 32½ m.p.h., and the two stages of the descent to Aylesbury, where there was a slight slack, produced maxima of 69 and 79 m.p.h. respectively. We were doing 69 m.p.h.

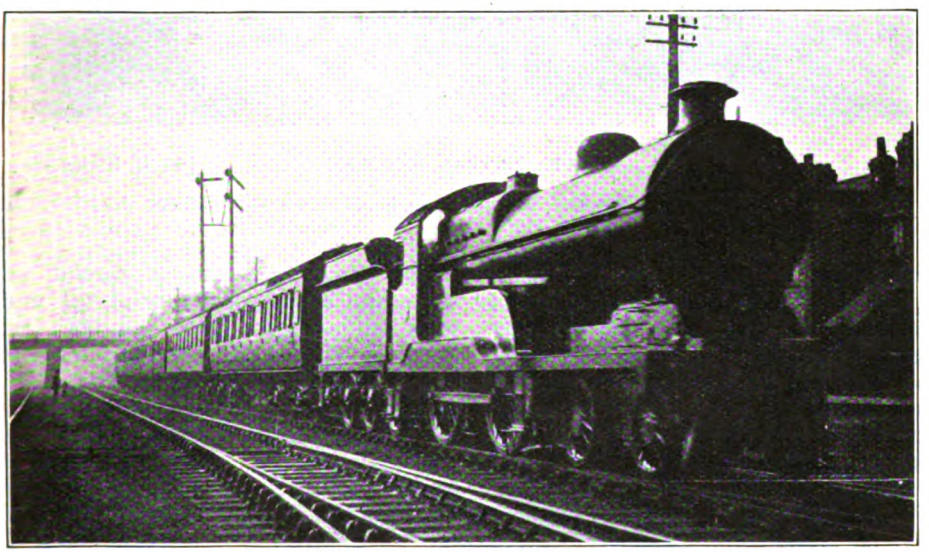

Photo.] GREAT CENTRAL RAILWAY. [*Henry L. Salmon*

Down Sheffield Express passing Leicester Locomotive Sheds.
4-4-0 "Director" class engine, No. 437, "Charles Stuart Wortley."

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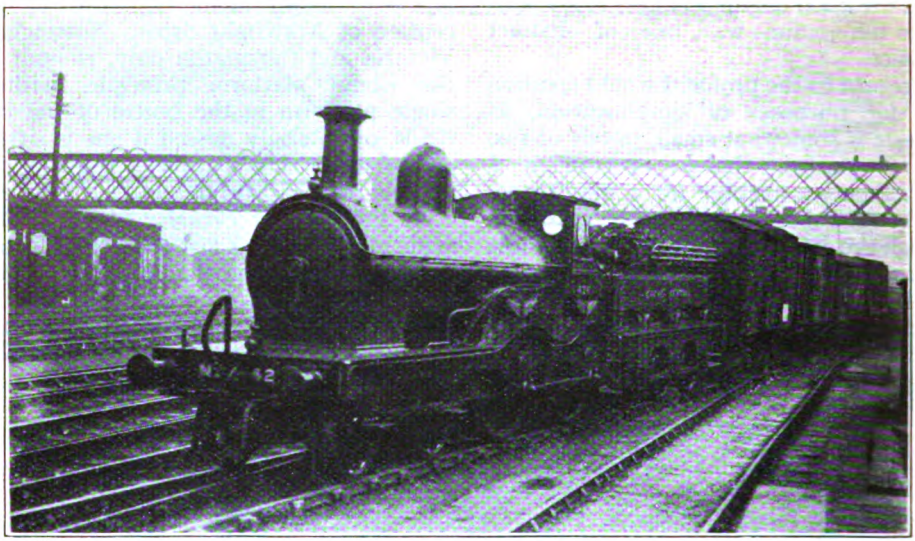

Photo.] GREAT CENTRAL RAILWAY. [*W. H. Whitworth.*

Old Sacré 4-4-0 locomotive, No. 428B, on a goods train at Guide Bridge.

between Aylesbury and Quainton Road, where we reduced to about 50 m.p.h., and touched 62½ m.p.h. on the dip after Calvert, before commencing the long ascent to Helmdon, whose two clearly-defined stages brought the speed down to 43½ and 45 m.p.h., with an intervening maximum of 60 before Brackley. At Culworth Junction we were doing 68 m.p.h. and at Charwelton 55, after which followed a headlong dash down to Leicester, a twice repeated maximum of 80½ m.p.h.—at Braunston and Whetstone—and another of 72½ beyond Rugby, supplementing minima of 64½ m.p.h. at Rugby, and 54 before Lutterworth. So we gained 2 min. to Leicester, despite the heavy load, and for an engine hauling, with its tender, fully 5½ times its own weight, the average of over a mile-a-minute from Amersham throughout to Leicester was an exceedingly fine one over such grades.

In the next column *Worsley Taylor*, very capably handled throughout to Manchester by Driver Johnson, of Neasden, put up some distinctly better running than *Gerard Powys Dewhurst*, on the third run. At Neasden the two engines got up to 67 and 65 m.p.h. respectively, and at Harrow fell to 47½ and 43½ m.p.h.; closely similar travelling followed to Aylesbury, with a maximum of 68 m.p.h. before Rickmansworth, a careful slack there and a sustained rate of 39½ m.p.h. up Chalfont Road bank, on both trips. We touched 74 and 72½ m.p.h. before, and fell to 53½ and 53 m.p.h. after, Missenden, ran under very easy steam for most of the way down to Aylesbury, touching 76½ and 74 m.p.h. and slacking there to 60 and 55, and pulled up to 50 m.p.h. over Quainton Road Junction. After Grendon Junction, which we passed at 65 and 61 m.p.h., *Worsley Taylor* began once again to draw away, maintaining 52 and 53 m.p.h. up the two stages of the ascent to Helmdon, against the 47½ of No. 507. Maxima at Culworth Junction were 70½ and 69 m.p.h. At Braunston, however, the positions were reversed, the top speeds being 80½ and 82 m.p.h.; minima at Rugby were 64 and 65 m.p.h., and maxima beyond 71½ and 72½ m.p.h.; falling to 50½ and 53½ m.p.h. on Lutterworth bank, we rose to 77½ and 79 at Whetstone, where *Worsley Taylor* was slacked slightly, whereas No. 507 continued at speed to a very brisk stop at Leicester, which was effected dead on time. *Worsley Taylor* completed the 79·5 miles from Amersham to Leicester in 76 min. 40 sec., at an average speed of 62·2 m.p.h., slacks at Aylesbury and Quainton Road included; No. 507's best bit was the time of 23 min. 50 sec. from

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Charwelton to Whetstone, 26·9 miles, average 67·7 m.p.h.

Somehow the performance of the two 4-cylinder 4-6-0's lacked the "snap" of the 4-4-0 journeys, and there was but little in the times to indicate that engines of so far greater tractive power were in use. *Earl Haig* distinguished himself only by some good climbing of the two worst banks; the maintained rate up to Amersham was 41 m.p.h., and on the lower and upper parts of the ascent to Helmdon the sustained speeds were 53 and 56½ m.p.h. The latter was certainly a notable figure, with this load, and another was the maximum of 75 m.p.h. reached at Culworth Junction. Together these afforded the surprising time of 9 min. 20 sec. from Brackley to Woodford—considerably the best in the table. Otherwise there was little to report; maxima were 64½ m.p.h. at Neasden, not over 66 in descending to Aylesbury, 66 beyond Calvert, 76½ at Braunston and 75 at Whetstone.

The distinctive feature of *Lord Faringdon's* run was the extraordinarily rapid start; 5¼ miles out of the London terminus we were doing 70½ m.p.h., well sustained—unique in my experience on any down journey at this distance from London—and the minima of 53½ m.p.h. at Harrow and 57½ at Northwood, with an intervening maximum of 67 at Pinner, were also unusual figures. Passing Rickmansworth, as also did *Earl Haig*, at a speed very much above that of the 4-4-0 engines (the maximum down from Northwood had been 71½), we fell to 39 m.p.h. on the ascent to Amersham, and touched 74 and 75 m.p.h. on the two stages of the run down to Aylesbury, where speed was slackened to 55 m.p.h. After that, little of note was done; maxima were 64½ m.p.h. after Grendon, 72½ at Culworth Junction, 76½ at Braunston, only 61 at Shawell after falling to 53½ at Rugby (very poor, this) and 77½ at Whetstone, while the chief minima were 48½ m.p.h. at Finmere and 51 before Helmdon. After my correspondent's reference to "expresses reaching their destination on the stroke of time," it is a truly singular thing that, on three consecutive runs with this express, very tightly timed over a non-stop run exceeding 100 miles, we arrived each time within 5 sec. of schedule at Leicester!

A brief reference is all that is needed to the runs from Leicester to Nottingham. No. 1027 did magnificently with the 320-ton train in the first column, passing Loughborough at 75 m.p.h. and attaining the same rate again at Ruddington, with a minimum of 55½ at Barnston. Net

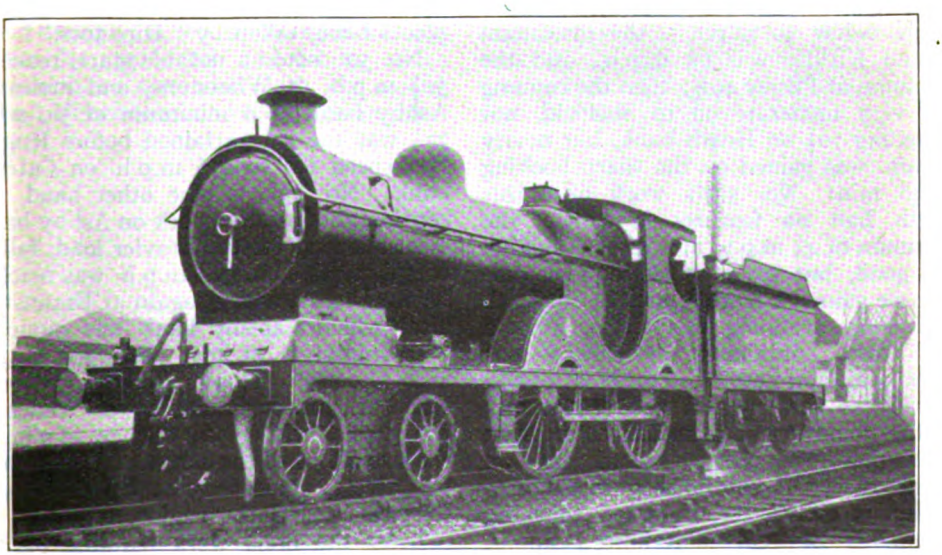

Photo.] GREAT CENTRAL RAILWAY. [*P. F. Cooke.*

4-4-0 Robinson Express Locomotive, No. 1015.
Re-built with large boiler and with Superheater.

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time was 26½ min., against 27 min. then allowed. Time now booked is 25 min., and *Worsley Taylor* would just have managed this, but for the concluding delay; we touched 76½ m.p.h. at Loughborough and 75 at Ruddington. No. 507 did a little better than this, with maxima at both points of 77½ m.p.h., and a minimum of 60 at Barnston, and gained 10 secs. Of the two 4-6-0's, *Earl Haig* only touched 71½ m.p.h. at each place, as against *Lord Faringdon's* 76½; minima at Barnston were 55 and 57½ m.p.h.; both engines made better starts from Leicester than the 4-4-0's, but the sluggish running of the former entailed a loss of nearly a minute, whereas the latter gained 10 sec.

From Nottingham to Sheffield honours rest easily with No. 1027 (first column) and *Worsley Taylor*. The first-mentioned was doing exactly 30 m.p.h. with this big train at Kirkby Junction, touched 56½ after Kirkby and fell to 43½ at Pilsley; then followed a top speed of 76½ m.p.h. on the descent to Staveley, with a slack to 55 through the latter place, and nothing of note thereafter. There was the mere excess of 25 sec. over schedule, which, added to the gain of ½ min. from Leicester to Nottingham, meant exact time-keeping throughout by No. 1027, and a fine achievement in the circumstances. No. 438 touched 53½ m.p.h. at Bulwell, and then went up to Kirkby without the speed falling below 46 m.p.h.; the maximum beyond Kirkby was 65 m.p.h., and the minimum at Pilsley 49½; then the running was very moderate on to Sheffield, not exceeding 70½ on Heath bank, but nearly 1¾ min. was gained on the sharp booking of 48 min. No. 507's work over this length had no features of note; the minimum of 44 m.p.h. at Kirkby Junction was good, but by poor subsequent running we gained a mere ¼ min. to Sheffield. *Earl Haig's* running was worse, after a good start; minimum at Kirkby was 39½ m.p.h., and maximum on Heath bank only 67, so that we did not recover any of the minute lost from Leicester from Nottingham—a pitiful record for an engine of such enormous power. *Lord Faringdon* did better, however, touching 55 m.p.h. at Bulwell, maintaining 43 m.p.h. up to Kirkby, and 52 up to Pilsley, with an intervening maximum of 65; then followed a hurricane descent to Staveley, which station we passed at 76½ m.p.h. The latter was to me an experience quite unique, as I have never previously run through this station without some reduction of speed. But for the final check, we should have run from Nottingham to Sheffield in 45½ min.

And now for the two up journeys, which were made on the 3.26 p.m. from Sheffield to Marylebone. *Earl Haig* did fairly well on the first stage to Nottingham, although with a very light train, gaining 1½ min. Maintained speed on the 1 in 100 from Staveley was exactly 40 m.p.h., and very cautious running followed on the subsequent descent. *City of Lincoln*, however, did very poorly, losing a minute on the journey; speed up the same bank in this case was 32 m.p.h.—a dismal exhibition. Smart starts were made on both runs from Nottingham, as far as Ruddington, beyond which *Earl Haig* developed a top speed of 64½ m.p.h., and breasted Barnston Summit at 56½; but *City of Lincoln* again did badly, falling to 47½ m.p.h. Both trains passed Loughborough at 70½ m.p.h., and then at last *City of Lincoln* woke up; the rise to Rothley was mounted at a minimum rate of 61 m.p.h., and a maximum of 70½ m.p.h. —a very unusual figure here—was attained before Leicester. Consequently both engines kept exact time from Nottingham to Leicester, where they came off, their places being taken by "Directors."

No. 506 made a notable start, reaching 56½ m.p.h. at Whetstone, and mounting Ashby bank at a minimum of 50, while 77½ was the rate attained before Rugby. But speed fell to 47½ m.p.h. on Catesby bank. No. 431, on the other hand, did considerably inferior work on Ashby bank, even allowing for the heavier load, falling to 43½ m.p.h., but 76½ m.p.h. was reached before Rugby, and 75 again at Braunston, after which Catesby bank was mounted at a minimum of 49½. Between Rugby and Quainton Road Junction, indeed, No. 431 gained 3 min. on the times of No. 507, touching 76½ and 79 m.p.h. on the two stages of the descent from Finmere to Calvert, against 75 at both points in the case of the latter engine.

After the brisk work required by the schedule to Quainton Road, the rest of the journey is by comparison easy, and was rendered still more sluggish on these

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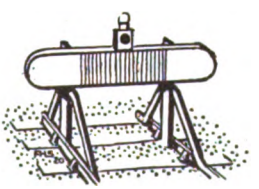
Photo.] SOUTH EASTERN AND CHATHAM RAILWAY. [*W. H. C. Kelland*

4-4-0 Superheater, class E1 locomotive, No. 160. London-Dover Boat Express passing Bickley. Train includes latest 64 ft. corridor stock.

trips by the absurd caution displayed at Quainton Road Junction, Rickmansworth and Harrow; the three slacks on the former run were to 45, 25 and 23 m.p.h., and on the latter to 34, 23 and 22! Indeed, the driver of No. 506 so overdid things as to arrive a minute late—a sorry finish after so fine a start. This engine maintained about 45 m.p.h. up Wendover bank, against No. 431's 38½, but fell to 50 at Amersham as compared with 55, speeds beyond Missenden being 69 and 68 m.p.h.; 70½ m.p.h. in both cases was the highest rate reached on Chalfont Road bank. Taken as a whole, this table, which, as I have said, includes all my Great Central runs consecutively for some months, presents a fine example of consistent time-keeping. The runs beyond Sheffield must be crowded out for the present, I fear, but I will make a point of dealing with them early, in company with the comparable Midland runs outstanding between Derby and Manchester.



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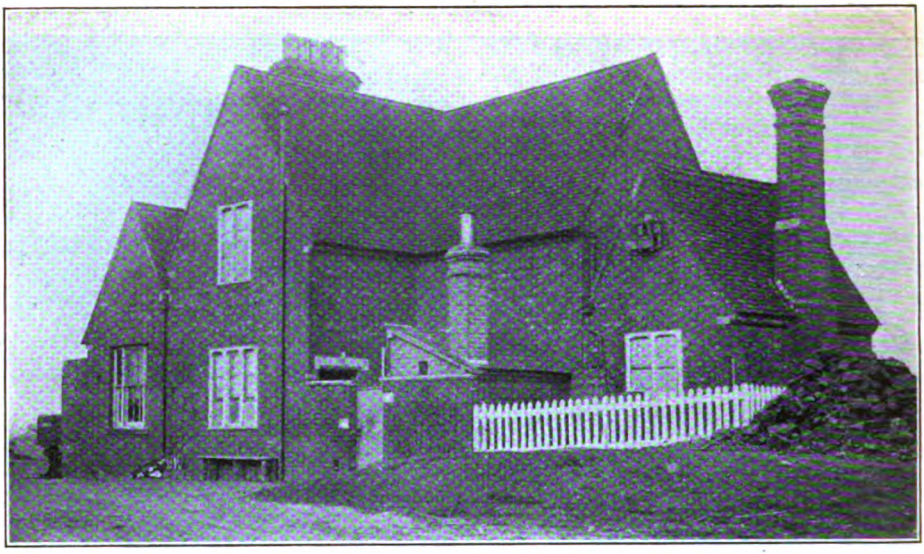

AMBERGATE RAILWAY STATION, GRANTHAM.

The Nottingham & Grantham Railway.

By H. L. HOPWOOD.

(*Photographs by the Author.*)

THIS railway, now leased to, and forming a very important section of, the Great Northern system, started its career with the name of the Ambergate, Nottingham and Boston and Eastern Junction Railway. Possessing such a high-sounding title, much might be expected of it, and in one sense, we are not disappointed, for although only 23 miles of line were constructed (as against the 90 miles allowed under the original Act), the company furnished more than one incident of historical interest in its early days.

The Ambergate, Nottingham and Boston and Eastern Junction Railway was incorporated by Act of July 16, 1846, "for the construction of a line commencing in conjunction with the Midland Railway, and in continuation thence of the Manchester, Buxton, Matlock and Midland Junction Railway at Ambergate, and terminating in conjunction with the Great Northern at Spalding, with branches from Wilby to Sleaford and from Pickworth to Boston (90 miles)." So reads the original prospectus, but at meetings held subsequently it was resolved, in the first instance, to construct only the portion of line between Grantham and Colwick. At the latter place a junction was to be formed with the Nottingham-Lincoln branch of the Midland Railway. A few years later the Ambergate Company made an independent extension into Nottingham and the physical connection with the Midland Railway was removed from Colwick to Nottingham. Traces of the Colwick junction are still visible in the form of a low embankment immediately west of Nether field Station. By the Act of 1846 the Ambergate Company was obliged to purchase the Nottingham and the Grantham Canals, and these undertakings are still maintained by the Great Northern Railway. The Nottingham Canal (incorporated 1792) extends from the Cromford Canal at Langley Mill to the Trent at Nottingham (14¾ miles), and the Grantham Canal (incorporated 1793) from the same river to the town of Grantham (33 miles).

At the outset the railway and canal companies were involved in law proceed-

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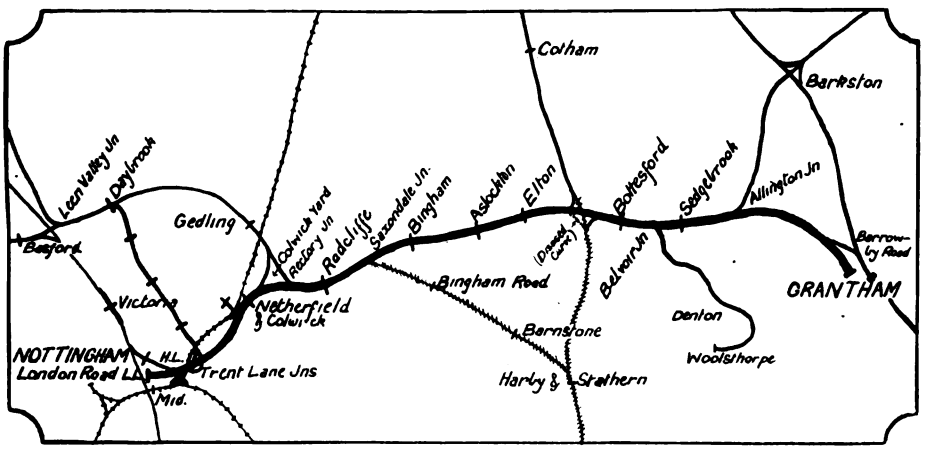
ings over the purchase of the latter's properties. The dispute arose as to the legal interpretation of the word "between" which occurred in a clause relating to the opening of the railway, and was held by one of the litigants to embrace the *entire* distance between specified points. It was not until 1854 that the matter was amicably settled.

On July 15, 1850, the railway was opened from the junction with the Midland Railway at Colwick to Grantham; trains running between the Midland station at Nottingham and the Ambergate Company's own station at Grantham. Thus, for two years it was the only railway at Grantham, as the portion of Great Northern main line between Peterborough very large majority of 37,103 votes an agreement was sanctioned, but almost immediately it was rescinded on an application made by the Midland and London and North Western Companies to the Vice-Chancellor. In consequence of this decision the Ambergate Railway retained its independence for some time longer.

The opening for goods traffic of the line between Peterborough and Retford occurred on July 15, 1852, and on August 1 following, the Great Northern Railway advertised a through passenger service between King's Cross and Nottingham, trains reaching the Ambergate line by means of a connection laid in at Grantham. The first of such trains to arrive at Notting-



THE NOTTINGHAM & GRANTHAM RAILWAY.

The original Junction at Netherfield and Colwick, marked "×," was subsequently removed.

and Retford was not completed until the summer of 1852.

Both the Midland and the London and North Western Companies saw a promising future for the Ambergate Railway, and in December, 1851, they attempted to enter into a joint working agreement with it for seven years, offering a 4 per cent. guarantee. But a prominent Great Northern shareholder, seeing likewise, defeated the attempt by the simple expedient of "cornering" the Ambergate shares. In May, 1852 the Great Northern Company endeavoured to enter into an agreement for the use of the railway and for its subsequent lease or sale, on terms similar to those previously made by the two companies already mentioned. By the ham was drawn by a Great Northern engine, and in this incident originates the oft-told tale of how the enraged Midlanders, bearing in mind the recently made injunction to restrain the Great Northern from carrying out its agreement with the Ambergate Company, promptly proceeded to capture the offending engine, lock it up in a shed and remove the rails leading thereto. Although, in the action which followed, it was proved that the Ambergate Company possessed legitimate running powers into the Midland station, and had merely *hired* the engine, seven months elapsed before the latter was returned to its rightful owners.

The agreement with the Great Northern Railway, previously referred to as being

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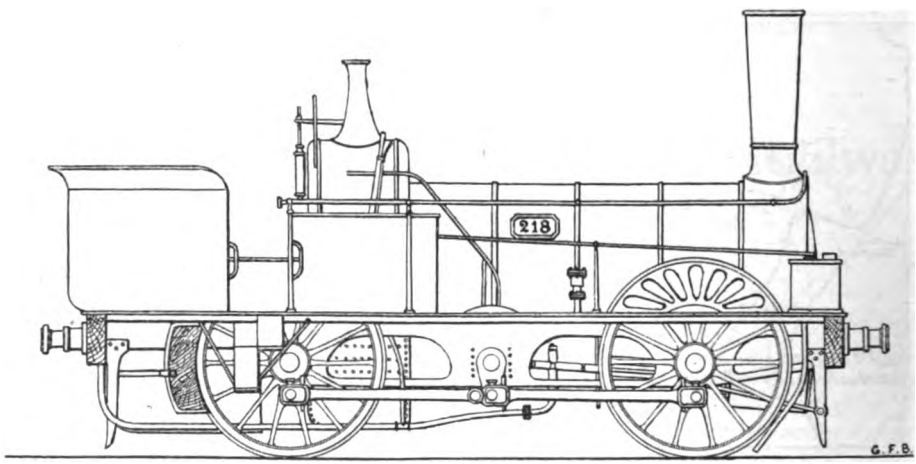
set aside by judicial decision, was legalised in 1854, and from April 2, 1855, the Great Northern took over all rolling-stock and other effects of the Ambergate Company and worked the line on the basis of 35 per cent. of gross receipts if exceeding £37,300 per annum or 30 per cent. if under that amount. By this time all Nottingham and Grantham trains had been diverted from the Ambergate to the Great Northern station at Grantham, and the former became disused as a passenger station. Part of the old building is still standing, and is illustrated by an accompanying photograph.

In its earlier years the line was worked under contract by the Leeds firm of E. B. Wilson & Co., a fact which probably accounts for all but one of the engines being built by them. The first locomotive superintendent was the late David Joy, but he resigned the position after a few months' service. Of the nine engines transferred in 1855 Nos. 1, 2 and 3 were 0-4-0 "Crampton" tanks, having intermediate driving shafts; they were, however, very soon rebuilt at Doncaster as 0-6-0 engines, the original 5-ft. wheels being retained. No. 4, built by Hawthorn, was a 2-4-0 with 6-ft. 6-in. wheels; No. 5, a 2-2-2 of "Jenny Lind" pattern, with 6-ft. 3-in. wheels; No. 7, a 2-4-0 with 5-ft. wheels; whilst the others, Nos. 6, 8 and 9, were 0-6-0 engines with 5-ft. wheels. They received Great Northern Nos. 218 to 222 and 391 to 394. By the courtesy of Mr. G. F. Bird we are enabled to include a line drawing of one of the 0-4-0 tank engines.

The three miles' extension from Colwick to Nottingham which had been authorised in 1854, was opened for traffic on October 3, 1857; thus, for the first time the Great Northern obtained access to the town without being dependent upon the Midland Railway for running powers. At London Road a handsome and commodious terminal station was provided, with a street frontage carried out in the Elizabethan style of architecture and platforms under cover of a three-span glazed roof.

It will be remembered that the Ambergate Company early decided to abandon its powers to construct lines west of Nottingham and east of Grantham, and in 1853 a scheme almost similar to that of the eastern portion was taken up by another company—the Boston, Sleaford and Midland Counties. This railway (worked by the Great Northern) was opened from Barkston to Sleaford on June 16, 1856, and finally to Boston on April 12, 1859. West of Barkston there was still a missing link necessary to complete a direct Nottingham-Boston line, and some years more were to elapse before it was provided. The territory between Ambergate and Nottingham is now occupied by the Midland Railway.

By an Act passed in 1860 the Ambergate Company, which for some years had been entitled to call itself the "Amber-



0-4-0 TANK ENGINE, No. 1 (LATER No. 218, GREAT NORTHERN RAILWAY).

(From a drawing by G. F. Bird.)

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gate, &c., Railway *and Canal Company,*" changed its title to the more convenient one of the "Nottingham and Grantham Railway and Canal Company," and from August 1, 1861, it was leased to the Great Northern Railway for 999 years (in lieu of the 1854 agreement) at a rental at the rate of £4 2*s.* 6*d.* per cent. per annum on the capital.

During the '70's and '80's the Great Northern Railway pursued a vigorous policy of expansion in the Midlands, approximately 150 miles of new lines, and the large sorting sidings at Colwick, being constructed in this period. All the additional traffic (largely coal) thus secured was carried over the Nottingham and Grantham line, and made that section of increasing importance. The first extension undertaken was that from Colwick to Pinxton, in 1875. Three years later this line reached Derby, and Egginton (for Burton), from Awsworth Junction, and in 1881 the Stafford and Uttoxeter Railway was absorbed and the Great Northern became established in Stafford, the westernmost point to which it has ever penetrated. The year 1875 also saw the opening of the line from Allington Junction to Barkston East, and this section completed what was practically the original project of the Ambergate Company—or of that part from Nottingham to Boston—for there was now a direct line between those towns. The connecting link has never been used extensively for passenger traffic, as, from a working point of view, Grantham is more convenient as a changing place, and the only regular passenger trains passing over the Allington-Barkston link are those in the summer months from Nottingham to Skegness. Another train formerly using it was a Wednesdays only express from Nottingham to Boston, but this has been suspended during and since the war. In 1878 the Bottesford West and Newark line was completed, and by the end of the next year the Great Northern and London and North Western Joint Railway was fully opened. Coming from the direction of Market Harborough, this line joined the Nottingham and Grantham Railway at Bottesford West and Saxondale, and the Bottesford-Newark line at Bottesford North. The Bottesford South to West curve is now abandoned, the South to East curve, made by the Great Northern Railway in 1880, being used instead. The completion of the joint line gave the London and North Western Railway an entry into Nottingham for all traffic. In 1881 was opened the important Leen Valley branch, which although not directly connecting with the Nottingham and Grantham section, was the means of putting much additional traffic over it.

EXTERIOR OF LONDON ROAD LOW LEVEL STATION, NOTTINGHAM.

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Opened in the first instance from Leen Valley Junction to Newstead, it was not until 1900 that the extension to Langwith Junction was finally completed. The mineral branch which diverges at Belvoir Junction, dates from 1883 and the Nottingham Suburban Railway from 1889; the latter extending from Trent Lane Junction to Daybrook. From 1893 to 1899 the Great Central Railway worked a service of trains between Sheffield and Nottingham (London Road) station; their extension from Beighton to Newstead (Annesley Great Northern Junction) being finished in the former year.

The approaching completion of the Great Central London Extension line rendered it imperative that the Great Northern Railway should possess accommodation more in the centre of Nottingham and better facilities for the interchange of traffic. Accordingly, it was agreed that the new "Victoria" Station, on the Great Central main line should be a joint Great Northern and Great Central undertaking, and that the first-named should construct new lines giving access to it. On May 24, 1900, the new station was opened, together with the Great Northern approach lines, viz., from Trent Lane West Junction to Weekday Cross Junction, on the south side, and from Bagthorpe Junction to Basford and Bulwell Station, on the north side. This new route decreased by seven miles the distance between Nottingham and all Great Northern stations west thereof. From the date mentioned London Road was called "Low Level," and fell into partial disuse, nearly all passenger trains being diverted to the new London Road "High Level" and Victoria instead. The old station has since been largely taken over by the Goods Department; the engine shed demolished, turntable pit filled in, and other alterations made, but six platform lines are still available. To-day the only Great Northern passenger trains accommodated there are the 5.20 a.m. to Shirebrook and the 7.30 a.m. ex-Melton Mowbray, the latter running on Wednesdays only. London and North Western trains from and to Northampton (numbering five arrivals and five departures daily) continue to use the station as formerly.

INTERIOR OF LONDON ROAD LOW LEVEL STATION, NOTTINGHAM.

Five running lines extend from Nottingham Low Level to Trent Lane Junction. There are also four lines from Colwick East to Rectory Junction; the same number between Radcliffe East and Saxondale Junction, and three from Gonerby to Barrowby Road, the additional track in the last-mentioned case being a loop for up freight trains. At Gonerby is situated a tunnel, 560 yards long, but the principal engineering feature of the line is the

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Radcliffe Viaduct over the River Trent and adjoining meadowland on the east side. This eastern approach, of a length of 960 ft., was originally constructed of timber in 32 spans, whilst over the river itself were two brick arches and a single iron span. The river spans remain, but the timber portion has been replaced by a viaduct of 28 brick arches, the width of each varying from 24 ft. 11 in. to 25 ft. 7 in. This renewal was completed in 1912.

In the "Railways Bill" the Nottingham and Grantham Railway and Canal Company is scheduled as "subsidiary" under the Eastern group, but until "grouping" is an accomplished fact the company remains a separate undertaking, with head offices at London Road Low Level station, Nottingham.

Railway Returns for 1921.

A PRELIMINARY statement of returns relating to the standard gauge railways of Great Britain for 1921 has been issued as a White Paper. Total capital expenditure was £1,161,300,000 in 1921, as compared with £1,155,900,000 in 1920 and £1,131,500,000 in 1913. On revenue account, gross receipts from the working of railways and other separate businesses were £236,000,000 in 1921 as compared with £257,800,000 in 1920 and £129,700,000 in 1913. Expenditure in 1921 was £245,500,000, against £251,800,000 in 1920 and £83,500,000 in 1913. But whereas in 1913 net receipts were £46,200,000, in 1920 they were only £6,000,000, and in 1921 there was actually a loss on working of £9,500,000. Miscellaneous net receipts of £3,800,000 reduced this deficit in 1921 to £5,700,000. In 1920 miscellaneous net receipts were £4,200,000, bringing the net earnings up to £10,200,000, and in 1913 miscellaneous receipts of £3,600,000 brought the total net income up to £49,800,000. Government compensation of £41,000,000, which was added in 1920 to the net earnings, brought the total net income for 1921 to £51,200,000. In 1921 the Government compensation was £51,000,000. Adding to this the £4,400,000, representing proportion of amount receivable under Section 11 of the Railways Act, 1921, gives, after allowing for the deficit previously mentioned, a total net income for 1921 of £49,700,000.

Total passenger train receipts were £105,400,000 in 1921, as compared with £109,300,000 in 1920 and £54,500,000 in 1913. Comparing 1921 with 1920 the decreases were entirely in ordinary first and third-class passenger receipts. Goods train traffic receipts were £109,700,000 in 1921 compared with £126,900,000 in 1920 and £64,200,000 in 1913.

Expenditure shows considerable variation as between 1920 and 1921. Thus, while maintenance and renewal of way and works increased from £33,400,000 in 1920 to £36,700,000 in 1921, maintenance and renewal of locomotives and rolling-stock from £45,900,000 to £49,300,000, and rates and taxes from £9,300,000 to £10,800,000, locomotive running expenses fell from £57,700,000 in 1920 to £52,500,000 in 1921, traffic expenses from £74,900,000 to £66,900,000, and compensation (accidents and losses) from £2,600,000 to £1,900,000.

Mileage of lines open for traffic, *i.e.*, total single track, including sidings was 51,315 in 1921, compared with 51,249 in 1920 and 50,425 in 1913. Total engine-miles in the three years were, respectively, 463,930,000, 554,353,275 and 599,737,146. In 1921 "engine hours in traffic" were 54,579,000 compared with 69,585,285 in 1920; train-miles per train-hour were 13·24 coaching and 8·81 goods in 1921, compared with 12·99 and 7·74 in 1920, and train-miles per engine-hour were 10·22 coaching and 3·41 freight in 1921, compared with 10·10 and 3·18 in 1920.

The number of wagon-miles run in 1921 was 3,780,299,000, of which 2,620,100,000 (or 69·31 per cent.) were loaded. Corresponding figures for 1920 were 5,026,490,775, 3,541,525,757 and 70·46 per cent.

Passenger journeys, exclusive of season-ticket holders, were 1,217,687,000 in 1921 compared with 1,567,469,716 in 1920 and 1,184,195,402 in 1913. Tonnage of goods and minerals, which was 364,162,358 in 1913 was 317,849,926 in 1920 and 217,488,000 in 1921. The average receipt per passenger journey for ordinary passengers increased from 10d. in 1913 to 1s. 4·2d. in 1920 and 1s. 6·2d. in 1921. The average receipt per season ticket was in 1921 £12 12*s.* 8*d.*, in 1920 £10 19*s.* 5*d.*, and in 1913 £8 4*s.* 4*d.* Season ticket holders (926,200) in 1921, while less than the 1,010,879 figure for 1920, show a decided advance in numbers over the 584,087 for 1913.

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Locomotive and Train Working in the latter part of the 19th Century.

THE CAMBRIAN RAILWAYS. [No. II.]

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

IN 1878 the first two 4–4–0 engines to be put into service on the line were built by Sharp, Stewart & Co.—Nos. 16, *Beaconsfield*, and 17, *Hartington*. These had 5 ft. 6 in. coupled wheels, 17 in. by 24 in. cylinders, and 140 lb. pressure. They were of a new standard design by the makers, with raised fireboxes, and were the first engines on the line to have six-wheeled tenders, the capacity of which was, however, only 1,600 gallons. These two engines increased the stock of main line passenger engines to 14, and with these the traffic had to be conducted for eight years longer until 1886, when Nos. 20 and 21 of the same class as Nos. 16 and 17 were added. In the meantime, names had been abandoned for new engines. There was another interval of five more years before Nos. 50 and 60, similar engines, appeared in 1891. It may be added that four exactly similar engines were supplied in 1890 to the Furness Railway, since the locomotive departments of the two railways continued to march in parallel lines, and what one did the other did too, or perhaps it might be said that Messrs. Sharp, Stewart & Co. recommended and did it for them.

The year 1888 saw the taking over of the old Mid-Wales Railway from Llanidloes to Tal-y-llin Junction. This added nine engines to the locomotive stock of the Cambrian Railways, of which three were mixed-traffic engines with four-coupled leading and driving wheels, 5 ft. diam., and cylinders 16 in. by 22 in. These and four of the goods engines were by Kitson and Co., 1864–5. The goods engines were somewhat similar to but not of the same design as those of the Cambrian, but two others by Sharp, Stewart & Co. were exactly the same as those of the latter railway. The Mid-Wales engines continued to work for some years on their old route, the passenger engines being Nos. 2, 23 and 24 of the Cambrian stock. Here, again, it is somewhat of a mystery how the passenger traffic over 52½ miles of line from Llanidloes to Brecon was conducted by three small passenger engines, but in 1889–90 I never saw anything else at Tal-y-llin Junction. The Mid-Wales had had six of these engines at one time, two of which they had sold 20 years earlier to the Manchester, Sheffield & Lincolnshire Railway, on which line they were regularly to be seen for many years in the Manchester district. The remaining engine appears to have been broken up before the Cambrian took over the Mid-Wales Railway. The Cambrian by this amalgamation added to its system the inland spas of Builth Wells, Llandrindod Wells and other Wells with unpronounceable names. In 1888 the two best trains over the 75¼ miles between Moat Lane Junction and Brecon averaged 2 h. 7 min. at a journey speed of 26 m.p.h., and a running average of 30½ m.p.h. exclusive of stops. This was, with the exception of the two best main-line fast trains, one in each direction, the highest speed then attained on the Cambrian. The main line trains in question averaged 28 m.p.h., including stops, on the 75¼-mile section between Whitchurch and Machynlleth Junction, the running average, exclusive of stops, being 34⅓ m.p.h. These trains were worked by the newer bogie engines, and although considerably heavier, showed an improvement of 6 m.p.h. over the 1880 speeds.

In 1891 the best down main-line train, the 1.40 p.m. from Whitchurch, arrived at Machynlleth at 4.15, a journey speed of rather more than 29 m.p.h. There were four stops of considerable duration at Oswestry, Welshpool, Newtown and Moat Lane Junction, which totalled 23 min., so that the average running speed was 34½ m.p.h. This train reached

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Aberystwyth at 5.15 p.m., but the North Coast connection, after leaving Barmouth Junction at 5.34, did not arrive at Pwllheli until 7.15.

The best run in 1891 was made by the 9 a.m. up express from Aberystwyth, which averaged 37·8 m.p.h. between Welshpool and Oswestry. The section from Machynlleth to Moat Lane Junction, over the Talerddig Bank, was covered by this train in 45 min., or at the rate of 30¾ m.p.h., with the help of a bank engine.

A new venture was also entered upon in the shape of through express trains between Aberystwyth and Merthyr, Newport and Cardiff via the Mid-Wales line. These trains travelled between Moat Lane Junction and Tal-y-llin Junction, but did not run into Brecon. At Tal-y-llin a Brecon and Merthyr engine was attached to the other end of the train to take it on its southward journey. The up train took 1 h. 50 min. from Tal-y-llin to Moat Lane Junction (56 miles), with three stops, and both ran between Three Cocks Junction, where the Midland line from Hereford joins the Mid-Wales, and Rhayader, without stopping even at Builth Road or Builth Wells. The train from South Wales was joined at Moat Lane Junction to a main line train from Oswestry, but the corresponding train in the opposite direction, which left Aberystwyth at 9.25 a.m., was independent throughout, and both were worked by Cambrian main line engines, generally of the 4–4–0 class, as the fast service was obviously beyond the powers of the old Mid-Wales mixed-traffic engines.

Trains were now increasing in number and length, and it was evident that the 18 passenger engines in use could not deal with the traffic. For the first time in its history the Cambrian proceeded to launch out in the direction of providing a sufficient number of suitable engines, and during the years 1893 to 1898 added 21 4–4–0 fast passenger engines of a new and heavier class. Whereas it had taken 30 years for the company to reach a total of 18 main line passenger engines, this number was considerably more than doubled within five more years.

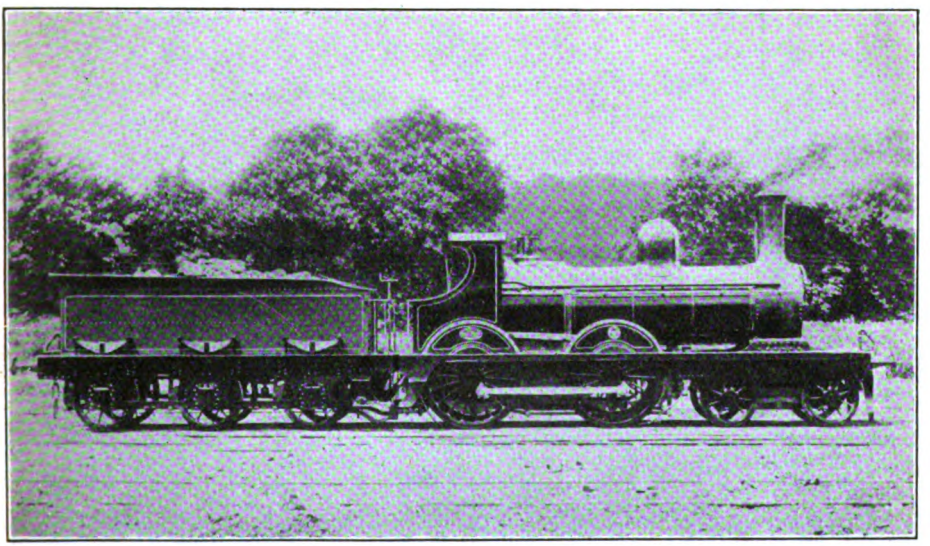

Photo.] **4-4-0 PASSENGER LOCOMOTIVE No. 21.** [*Loco. Publishing Co. Ltd.*
Built by Sharp, Stewart & Co., 1886.
Coupled wheels, 5 ft. 7 in. Cylinders, 17 in. by 24 in.

The general designs for the new 4-4-0 engines were made by Mr. Aston, then chief locomotive superintendent. They have 6 ft. coupled wheels, 18 in. by 24 in. cylinders, and 160 lb. pressure. The total heating surface is 1,156½ sq. ft., and the engines weigh 40¼ tons in working order. Of them, 16—Nos. 61 to 72 and

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81 to 84—were built during 1893 to 1895 by Sharp, Stewart & Co., and the other five, Nos. 32, 47, 85, 86 and 11, by R. Stephenson & Co. in 1897–8. It is again worth recording that the Furness Railway once more followed suit, and in 1896 obtained six similar engines from Sharp, Stewart & Co.

These engines immediately took up the working of nearly all the main line and Mid-Wales trains, a few secondary trains being left under the charge of the older 4-4-0 engines of 1878 to 1891. The 12 old 2-4-0 veterans of 1863–5, which had been rebuilt with new boilers between 1890 and 1894, were then relegated for the most part to the coast lines for the stopping train services.

During the same period the working of the goods traffic, which necessitated additional power, was also taken in hand. No new goods engines had been added to the stock for nearly 20 years, and those in use of the old Sharp, Stewart design with 16-in. cylinders were now too small for more modern requirements. Ten new goods engines of much greater power were built during the years 1895 to 1898 from Mr. Aston's designs, seven by Neilson & Co. and three by The Vulcan Foundry Limited. These have 18 in. by 26 in. cylinders, 5 ft. 1½ in. wheels, 160 lb. pressure and 1,084½ sq. ft. of heating surface. In addition to working the heavier goods trains, they were intended for and frequently used on summer excursion trains.

The most important extension of the Cambrian Railway was opened in 1895 in the shape of the Wrexham and Ellesmere Railway, 12¾ miles in length, which made a connection through Wrexham with Liverpool, via the then Wrexham, Mold and Connahs' Quay Railway, the Manchester, Sheffield and Lincolnshire Railway, and the Mersey tunnel. This line shortly afterwards enabled through fast trains to be run from Manchester (Central) to Aberystwyth and Barmouth via Chester. It should, however, be added that the Wrexham and Ellesmere Railway is an independent company leased to and worked by the Cambrian.

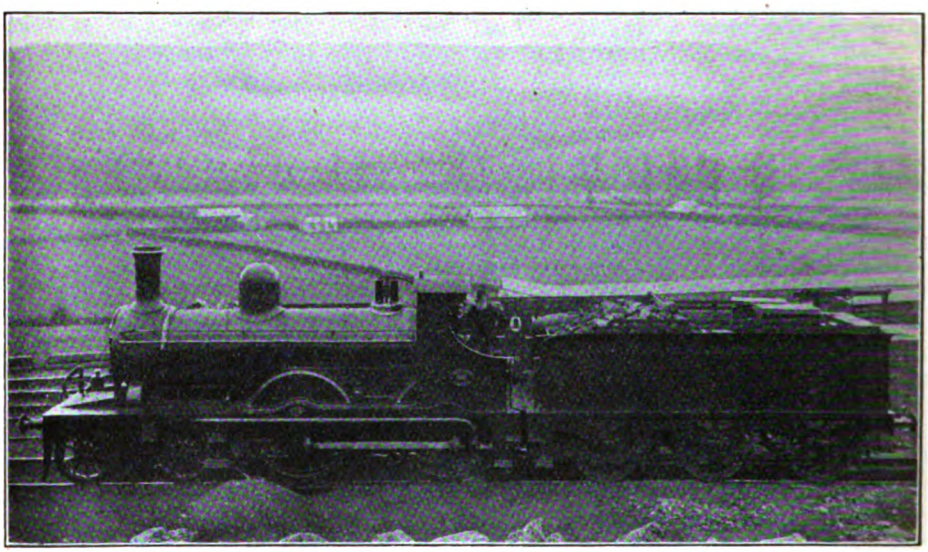

Photo.] **4-4-0 PASSENGER LOCOMOTIVE, No. 83.** [*Loco. Publishing Co. Ltd.*

(61 class). Built by Sharp, Stewart & Co. Ltd., 1893-1895.
Coupled wheels, 6 ft. Cylinders, 18 in. by 24 in.

The engines built for this section were of the 0-4-4 bogie side tank type, and inaugurated a new locomotive departure for the Cambrian. Three of them, Nos. 3, 5 and 7, were constructed by Nasmyth, Wilson & Co., of Manchester, in 1895, and were followed in 1899 by three more of the same class, Nos. 8, 9 and 23. The cylinders are 17 in. by 24 in., and the leading coupled wheels have a diameter

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of 5 ft. 3 in. The boilers, which carry 150 lb. pressure, have a total heating surface of 1,010 sq. ft.

The Cambrian was a line which for many years was remarkably free from serious accidents. In 1883 a fall of rock near Llwyngwril on the coast line between Aberdovey and Barmouth caused a passenger train to leave the rails. The line at this point passes round the edge of the cliffs on the coast, and the engine and tender were thrown down on to the beach, the driver and fireman being killed.

But a serious disaster occurred in the summer of 1897 at Welshampton, between Oswestry and Whitchurch, to a heavy excursion train returning from Barmouth to Lancashire, when 11 persons were killed. The train was drawn by two of the new goods engines, Nos. 75 and 77, when the tender of one of the engines was stated to have left the rails, and the whole train followed. The origin of the accident was attributed to defective permanent-way, but the Cambrian officials were of opinion that a light four-wheeled brake van belonging to the Lancashire and Yorkshire Railway was the real cause. It may be mentioned that the line in this district crosses an area of peat moss, very similar in nature to that of the celebrated Chat Moss of Liverpool and Manchester fame, but whether this had any connection with the defects which were stated to have existed in the permanent-way did not appear. Trains had run over it for 35 years without any trouble whatever.

One other addition to the Cambrian system was made before the close of the century, This was the derelict Van Railway, the working of which was taken over in 1896. The line, which is about 6¾ miles long, branches from the Cambrian main line at Caersws and goes to the Van mines. There was no passenger traffic, which, having been found unprofitable, had been discontinued many years before, and the mineral traffic had also ceased a few years before the Cambrian was asked to look after the railway. This they did by running three trains in each direction per week, to the lead mines.

In 1899 the two best down trains were the North Express, which had connections from Manchester, etc., and left Whitchurch at 12.20 p.m., and the 1.50 p.m. from Whitchurch, which conveyed the through carriages from London, Birmingham, etc., attached at Welshpool. The North Express took 3 hours 5 min.

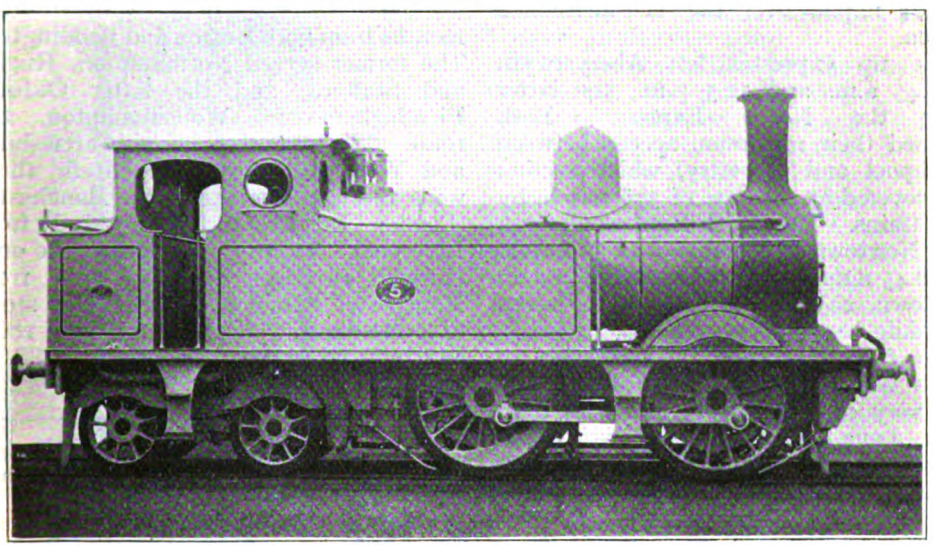

Photo.] **0 4-4 BOGIE SIDE TANK LOCOMOTIVE, No. 5.** [*Loco. Publishing Co. Ltd.*

Built by Nasmyth, Wilson & Co. Ltd., 1895.
Coupled wheels, 5 ft. 3 in. Cylinders, 17 in. by 24 in.

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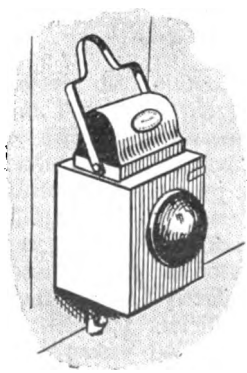
for the journey of 95¾ miles to Aberystwyth, an overall journey speed of just over 31 m.p.h., including seven stops. The best speeds of this train were 36½ m.p.h. from Whitchurch to Oswestry 37¾ m.p.h. from Oswestry to Welshpool, and 36·9 m.p.h. from Moat Lane Junction to Machynlleth. Over the comparatively easy section from Glandovey Junction to Aberystwyth the speed was only 26·4 m.p.h. for the 16¾ miles, with one conditional stop at Borth. The 1.50 p.m. from Whitchurch was somewhat slower to Machynlleth, and faster thence to Aberystwyth, than the North Express, and managed to attain an average speed of 30¾ m.p.h. over the last-mentioned section.

The up expresses left Aberystwyth at 8.45 a.m. and 12.5 p.m., the latter being the North Express. Both attained their maximum speeds between Welshpool and Oswestry, which section was covered at the rate of 37¾ m.p.h. by both trains. The North Express also ran from Newtown to Welshpool at 33 m.p.h. The 8.45 a.m. ran from Cemmes Road to Newtown, 22¼ miles, including the steep Talerddig bank, at 29 m.p.h.

The fast train from the Cambrian to South Wales over the Mid-Wales section was very smartly timed, and ran from Moat Lane Junction to Three Cocks Junction, 48 miles, in 1 hour 37 min., with three stops, of which that at Builth Road occupied 10 min., possibly to ensure punctual crossing arrangements. The run of 25¼ miles from Llanidloes to Builth Road was booked to be done in 43 min. at a speed of 35¼ m.p.h., a particularly smart single line performance. The same section in the opposite direction was, however, given 10 min. longer. These trains were not booked in Bradshaw to stop at Tal-y-llin Junction, although it was necessary to make a service stop in order at Tal-y-llin South to change engines with the Brecon and Merthyr Railway.*

By the end of the century a marked feature of Cambrian enterprise was the number of through carriages which were worked to Abersytwyth during the summer months from both Euston and Paddington. The former served Northampton, Rugby and Stafford, and the latter Oxford, Birmingham and Wolverhampton, the route taken by both being via Shrewsbury and Welshpool. From the north there were through carriages from Manchester (London Road and Central) and from Liverpool. Twenty years earlier the only through carriages had been run from Manchester (London Road). The stock of locomotives, which had been 59 in 1866, and only 60 in 1892, had risen to 88 in 1899.

* These trains ran *via* the East Curve at Tal-y-llin, but I do not know the date when this arrangement was inaugurated.—E.L.A.



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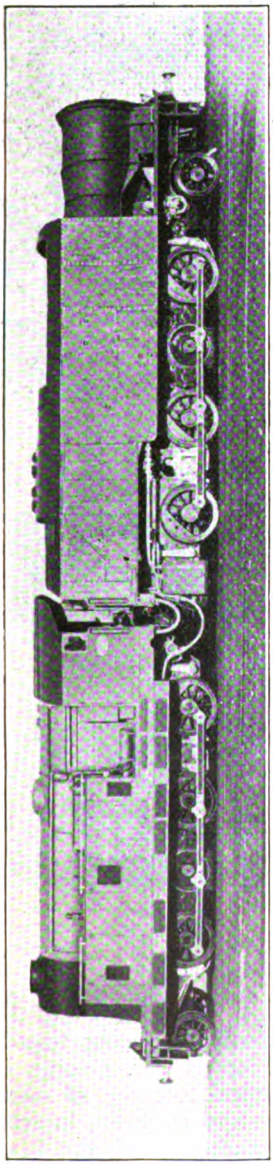
Turbo-Electric Locomotive Development.

DURING the latter part of last year a RAILWAY MAGAZINE representative was permitted to examine the new Ramsay turbine locomotive during its construction at the Scotswood Works of Sir W. G. Armstrong, Whitworth & Co., Limited Newcastle-on-Tyne, on which occasion the originator, Mr. D. M. Ramsay, Managing Director of the Ramsay Condensing Locomotive Company, Limited, of Glasgow, explained the principal features of the design. A very great deal of ingenuity, time and thought have been expended upon this locomotive, which may be regarded as the second practical attempt made in this country to introduce the condensing turbine locomotive with electric transmission, the first one being the Reid-Ramsay locomotive built by the North British Locomotive Company, Limited, Glasgow, and tried on the Cowlairs Incline, Glasgow, in the year 1910.



THE RAMSAY CONDENSING TURBO-ELECTRIC LOCOMOTIVE.

In locomotives of this type the principal, and indeed, the primary object, is to economise in fuel and water, and a superheater boiler with, in this case, a total heating surface of 1,453 sq. ft., is provided for generating steam for actuating the main and auxiliary turbines. A condenser of novel design is installed into which the exhaust steam from the turbine is discharged, through a large diameter pipe, being expanded down from boiler pressure to a vacuum of 27½ in., the condensate being drawn off from the condenser by a rotary extracting pump and returned to the well, from which a feed pump delivers the water into the boiler, thus completing the cycle.

In effect the Ramsay locomotive is two separate units which, when coupled together, to a large extent resemble a locomotive with its tender as in ordinary practice. As a matter of fact, however, both units form separate engines coupled together. The front one, both as regards the boiler and framing, differs but little from accepted locomotive practice, with the exception, of course, that the features of the cylinders, reciprocating parts, &c., are replaced by a turbo-generator, this being supplied by the Oerlikon Company, of Zurich. The main turbine is of the impulse pressure compounded multi-stage type, connected through a flexible coupling to a three-phase generator capable of sustaining a 25 per cent. overload for half an hour. This generator is separately excited by an auxiliary turbine-driven direct-current generator. The three-phase generator supplies power to four three-

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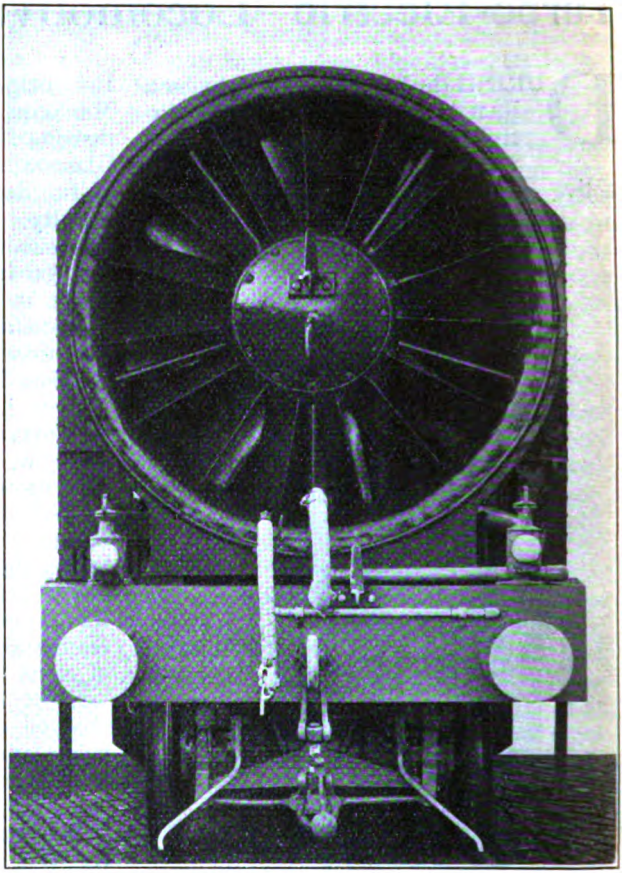
phase slip-ring motors arranged in two groups on the front and rear parts of the locomotive respectively. The two motors of each group are bolted to a common stretcher carrying a countershaft to which the motors are geared. The power is then transmitted from the countershaft to the six driving wheels on each engine unit by coupling rods in the ordinary manner. Each of the motors is capable of developing 275 h.p.

The rear engine incorporates the coal bunker and cooling water tank, as well as the condenser and its appurtenances. The condenser is of the evaporative type supplied with air by a fan at the rear of the engine. The steam tubes of the condenser are arranged in the form of a cage, which is caused to revolve in water at slow speeds and through which the air is impelled by the fan in a radial direction over the tubes.

The boiler is hand fired and fitted for forced draught. The driver manipulates the locomotive by means of a master controller placed in the cab.



REAR VIEW OF THE RAMSAY TURBO-ELECTRIC LOCOMOTIVE SHOWING CONDENSER FAN.

Leading particulars are :—

Length over-all	69 ft. 7 in.
Length, wheelbase	59 ft. 4 in.
Length, rigid wheelbase ..	16 ft. 4 in.
Weight on driving wheels, average	18 tons.
Driving wheel diameter ..	4 ft.
Height from rails to centre of boiler	10 ft. 3 in.
Width, maximum	8 ft. 11 in.
Weight of front engine ..	67 tons 5 cwt.
Weight of front engine, light	63 tons 5 cwt.
Weight of rear engine ..	63 tons 10 cwt.
Weight of rear engine, light	48 tons 3 cwt.
Total weight, including 2,200 gallons of water for cooling purposes and 4 tons of coal	130 tons 15 cwt.
Total heating surface with superheater	1,453 sq. ft.
Grate area	28·4 sq. ft.
Boiler pressure	200 lb. per sq. in.
Superheat	300 deg. Fahr.
Adhesion Weight	108·5 tons.
Tractive force	22,000 lb.
Ratio of adhesion to tractive force	11·05.
Turbo-generator	890 kw. at 3,600 revs. and 27½ in. vacuum, voltage 600.
Gauge	4 ft. 8½ in.

The locomotive is being tested under the supervision of Mr. George Hughes, Chief Mechanical Engineer of the London & North Western Railway, in accordance with the running conditions. It was subjected to a preliminary test in the builders' yards at Newcastle before being sent to Horwich.

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Essex Coast Branches of the Great Eastern Railway.

(Photographs by J. F. Gairns.)

II.—THE CLACTON, WALTON AND BRIGHTLINGSEA BRANCHES.

(*Continued from page* 230.)

THE main line station at Colchester is really on the outskirts of the town, as were so many of those built in early days, though it is well served by the local tramways, which terminate close by. At the south end is used for terminating trains off the branch and for the Brightlingsea locals. A run-round road is available for the use of the latter, but as many of the Clacton trains, if not through to or from London, have through coaches, they are frequently

CLACTON-ON-SEA STATION.
Exterior.

end, on the down side, are the carriage sidings and goods yard, and to the north, on the same side, are the engine sheds; but there is only the one long main platform for down traffic. The up platform, even longer than that opposite to it, has a terminal bay at each end. That to the south is used for stopping trains to London, or trains to Marks Tey and the Sudbury line, which start from Colchester, while the bay at the north dealt with at the main line platform. Both the up and down main are well covered almost from end to end, all usual station offices are available, and each has refreshment and tea rooms under the management of the company.

Leaving the main line, the branch descends on a falling gradient, curving away to the right in almost exactly the same way as does the Southend branch from Shenfield. About 1½ miles along,

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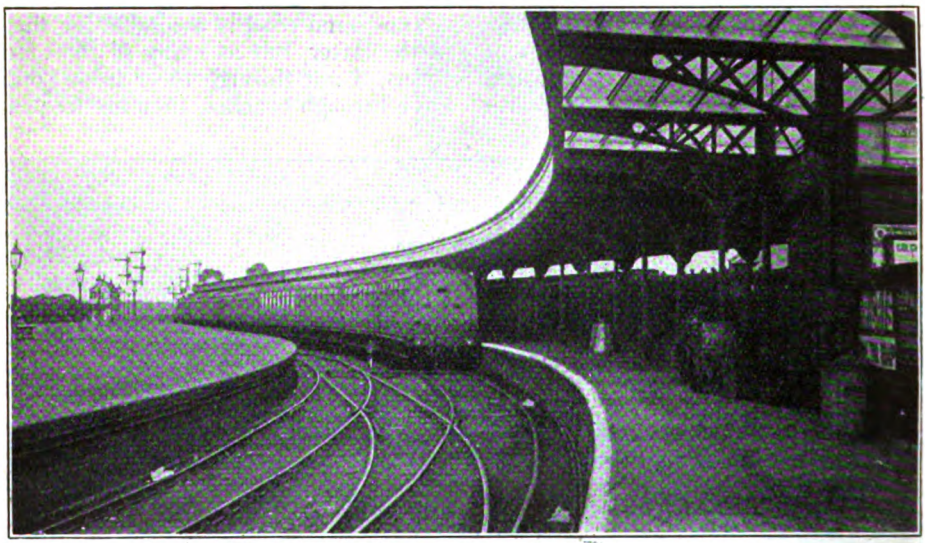
a triangle is met with, giving connections on both down and up journeys with St. Botolph's station, in the centre of the town of Colchester, and, therefore, considerably used for local traffic, though little known to passengers whose only acquaintance with the line is derived from through journeys. The branch gives access to several industrial establishments in the town, as also at Hythe and Wivenhoe, a centre for yacht-building and the construction of small vessels. The St. Botolph's branch is double, but the station, which is terminal, includes only one platform, with the station buildings behind the buffer stops and the goods yard alongside. Two and a-half miles beyond Hythe is Wivenhoe station, a junction, but with only the usual two platforms. About a quarter of a mile beyond is Wivenhoe Junction, whence the Brightlingsea line diverges on the up side, at once becoming single track, controlled by train staff without tickets and by one engine only in steam (or two coupled together). The line follows the River Stour very closely, in places crossing an arm by means of a pile-supported viaduct, and this run of 5 miles is exceedingly picturesque, giving as it does splendid views of the widening estuary, usually enlivened with the white sails of small yachts—Brightlingsea is a great yachting centre—and with the water close alongside all the way. Approaching the terminus the line diverges inland a little, to reach the town, with its yacht-building and repairing yards on the industrial side, and its provision for holiday makers on a small scale towards the sea. A single platform is, of course, sufficient.

Beyond Wivenhoe, towards Clacton, there is nothing of outstanding interest until Thorpe-le-Soken is reached. It is double-track throughout, and the stations, most of which are centres for agricultural traffic, have the usual platforms and equipment, with goods yards in each case. At Thorpe-le-Soken there is an island on the up side to enable Clacton and Walton portions to be in the station together and for joining up. Outside is a run-round line for branch engines. On the down platform is a small refreshment and tea-room. The Walton line is much the older, but both that and the Clacton line are single lines controlled by electric train tablet. On the former, Kirby Cross is a crossing station, though at Frinton-on-Sea—a quiet resort now in considerable favour—there is only one platform, on



CLACTON-ON-SEA STATION.
Interior.

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the up side, as it is not adapted for crossing trains. The terminus at Walton-on-the-Naze has one platform, with goods yard, sidings, &c., and a small engine shed. The Clacton line, though nearly 5 miles in length, has no intermediate station, and the crossing at Great Holland is at present closed, only one track being used of the two provided for passing purposes. Clacton-on-Sea station has arrival and departure lines on either side of one long platform, with a further double-sided uncovered platform with separate access from the roadway for excursion and like special traffic. The station offices are complete, and include refreshment rooms, somewhat unusually with outside doors as well as from the circulating area. Carriage sidings, a goods yard and engine shed complete the equipment of the station.

Train services on the Clacton branch may be placed in four divisions, though some are related, as will be seen. These are :—(1) The through express trains between London and Clacton and Walton, several including restaurant or Pullman cars; (2) branch connections with main line trains; (3) the Brightlingsea trains; and (4) the St. Botolph's services. Non-stop expresses have in the past been regularly scheduled between Liverpool Street and Thorpe-le-Soken, where Clacton and Walton sections are separated; but at present only one does so (5.30 p.m. down), and the best trains call at Colchester and generally at Chelmsford also. These, though usually quite heavy, are always worked by 4–4–0's of the "Claud Hamilton" class, or occasionally by "T.19" class superheater rebuilds. The usual over-all time is about 2 hours, though two or three trains are appreciably quicker, the best being the 5.30 p.m. down, in 1 hr. 42 min.

The chief morning down service is the 10.26 a.m. from Liverpool Street, which conveys a third-class Pullman car and calls at Ilford to pick up only, Chelmsford, Colchester, Hythe, Wivenhoe, and Thorpe-le-Soken, reaching Clacton at 12.34 p.m. and Walton at 12.43 p.m. The 12.35 (Saturdays only) is another busy train, calling at Chelmsford, Marks Tey, Colchester, Wivenhoe and Thorpe-le-Soken, due at Clacton 2.40 p.m. and Walton 2.48 p.m. On Saturdays a fast restaurant car express is run at 1.30 p.m., stopping at Chelmsford and at Colchester only to Thorpe-le-Soken, due Clacton 3.20 p.m. and Walton 9 minutes later. The 3.20 runs similarly to the 12.35 p.m., save that it does not call at Marks Tey, and reaches Clacton at 5.20 p.m. and Walton 5.28 p.m. A considerable number of residential season tickets are issued for this route, and business men have two useful expresses for their return from town in the 4.58 and 5.30 p.m. The former runs on Saturdays, when it has a third-class Pullman car, but does not include restaurant cars, as on other week-days; the latter is the fastest service of the day, but does not run on Saturdays. It has restaurant cars, but these go to Walton, the connecting service being to Clacton from Thorpe-le-Soken in this case. The 4.58 p.m. calls at Chelmsford, Witham, Marks Tey, Colchester, Wivenhoe and (on Tuesdays when required) at Great Bentley, but is, nevertheless, booked to reach Clacton at 7 p.m. and Walton at 7.8 p.m. It is, however, nearly caught up by the 5.30 p.m., which makes its first stop at Thorpe-le-Soken, the Clacton portion reaching its destination at 7.12 p.m. (in 1 hr. 42 min.) from London, and the Walton portion (with the restaurant cars) at 7.19 p.m. A still later business service is provided by the 6.39 p.m. (not Saturdays) from Liverpool Street, which conveys third-class Pullman cars, and on a similar schedule to the 12.35 p.m. is due at Clacton at 8.34 p.m. and Walton at 8.42 p.m. The 12.35 p.m. calls at Marks Tey both in winter and in summer, but the 6.39 p.m. does not call at Marks Tey. A good connection is given off the 7.45 p.m. from Liverpool Street, while the 8.45 p.m. is a through Clacton and Walton train, due respectively at 10.53 and 11 p.m.

In the opposite direction the up trains in the morning are the most interesting, as they cater both for business travel to town and for returning week-enders. The 6.55 a.m. from Clacton (5 minutes earlier from Walton) conveys restaurant cars, and maintains the usual features of stops at Colchester, Chelmsford and Shenfield after leaving Thorpe-le-Soken, reaching Liverpool Street at 8.52 a.m. The 7.37 a.m. includes third-class Pullman cars and stops also at Wivenhoe (for the Bright-

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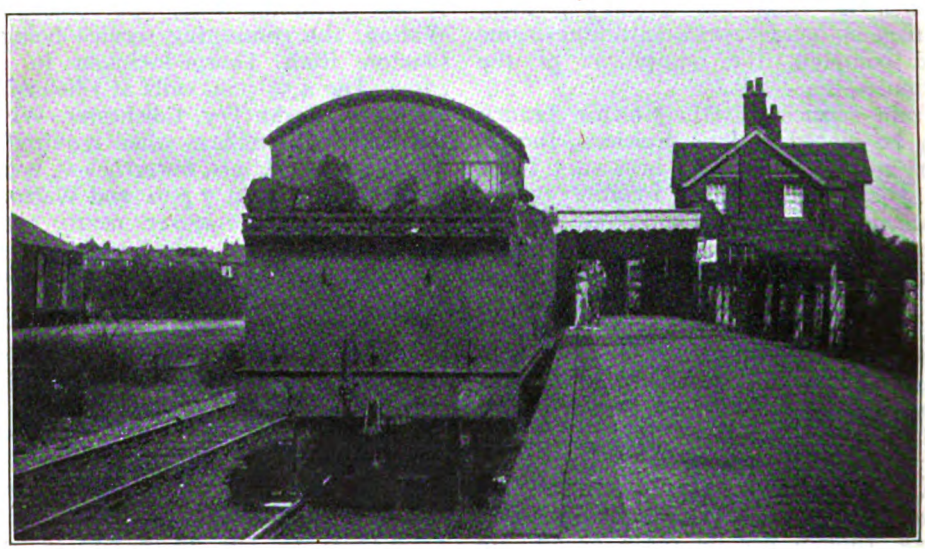
lingsea connection and to transfer passengers from the 7.20 a.m. slow train from Clacton), and is due in London at 9.36 a.m. The 8.4 from Clacton conveys the restaurant cars from Walton at 7.58 a.m., and stops at Colchester and Marks Tey, due Liverpool Street 9.54 a.m. Of the other trains the 9.50 a.m. from Clacton completes its journey in 1 hr. 53 min.; the 1.32 p.m. occupies 2 h. 5 min., and includes third-class Pullman cars, and the 2.55 p.m. Saturdays (3 p.m. other days) is due at 4.58 p.m. This latter train does not run through to Liverpool Street in the winter months; it connects at Colchester with the 1 p.m. from Cromer, due at Liverpool Street 4.58 p.m.

Besides these, however, the 5.0, 8.15, 8.46, 11.38 a.m., 2.15, 3.26, 5.42, and 7.45 p.m. trains from London have stopping or semi-fast branch connections, while the 11.40 a.m., 2.16 (Saturdays), 2.26 (except Saturdays), 4.20, 5.55, and 7.38 p.m. up trains connect at Colchester with trains for London. In the down direction the connections off the 2.15, 3.26 and 5.42 p.m. trains run from the main line station at Colchester into St. Botolph's. As a rule, however, the Brightlingsea branch train is used to serve St. Botolph's, and it will be interesting to trace out the working of this train in conjunction with other services.

Leaving Brightlingsea at 7.36 a.m., it runs first to Wivenhoe only, due 7.49 a.m., to connect with the 7.37 a.m. ex-Clacton. In advance of the latter is the 7.20 a.m. stopping train from Clacton, which runs only to Wivenhoe (due 7.57 a.m.), and after the departure of the through train continues to St. Botolph's and thence to Colchester (North). Meanwhile the Brightlingsea train has returned from Wivenhoe at 8.10 a.m. Its next journey from Brightlingsea at 8.37 a.m. is through to St. Botolph's and Colchester (the engine runs round the train at St. Botolph's), and the same applies to the 9.25 a.m. from Colchester to Brightlingsea. Leaving again at 10.10 a.m., it runs again to Colchester via St. Botolph's. It then works the 10.55 a.m. from Colchester to Wivenhoe via St. Botolph's (not stopping at Hythe) to connect with the 11.10 a.m. direct from Colchester. Off this it gives a Brightlingsea connection. Leaving Brightlingsea again at 11.55 a.m., connecting at Wivenhoe with the 11.40 a.m. ex-Clacton, it runs to St. Botolph's. At 1.9 p.m. it returns to Wivenhoe, and is shunted there until 1.33 p.m. (except Saturdays) or 2.14 p.m. (Saturdays only), when it leaves as the Brightlingsea con-



BRIGHTLINGSEA TERMINUS.

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nections off the 11.38 a.m. and 12.35 p.m. from London respectively. Returning at 2.40 p.m., it connects at Wivenhoe with the 2.16 or 2.26 p.m. ex-Clacton, and follows as the 3.14 p.m. to St. Botolph's. It remains there until 4.31 p.m., when it proceeds to Wivenhoe, and after the arrival of the 3.20 p.m. ex-Liverpool Street proceeds at 5 p.m. to Brightlingsea. Leaving again at 5.32 p.m., it makes a through journey to Colchester (not St. Botolph's), and returns at 6.15 p.m., serving St. Botolph's, but not stopping at Hythe, and working through to Brightlingsea. At 7.17 p.m. on Saturdays it runs to Wivenhoe to provide the branch connection off the 5.42 p.m. ex-Liverpool Street. On other days it leaves Brightlingsea at 7.42 instead, returning from Wivenhoe at 8.10 p.m. as a connection off the 6.39 p.m. ex-Liverpool Street. At 8.50 it forms the last train from Brightlingsea, working through to St. Botolph's, and the day's work is concluded by the 9.30 p.m. from St. Botolph's to Brightlingsea, taking passengers at Wivenhoe from the 7.45 p.m. from London.

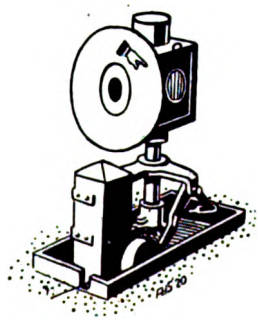
On Sundays the principal trains on this group of lines are the 9.20 a.m. and 4.40 p.m. from London to Clacton, the one due at 11.52 a.m. and the other at 6.40 p.m. Local services are given at 10.53 a.m. from St. Botolph's, providing a Brightlingsea connection with the 9.20 a.m. from London, and similarly at 7.16 p.m. in connection with the 7.25 p.m. train from Colchester to Clacton. Up stopping trains leave Clacton at 9 a.m. for Colchester (due London 11.38 a.m.), the Brightlingsea train following from Wivenhoe as a local to St. Botolph's, and 6 p.m. (due Liverpool Street 9.5 p.m.), with an express at 7.50 p.m., due in London at 10.15 p.m. The Brightlingsea train at 6.17 p.m. connects at Wivenhoe with the 6 p.m. ex-Clacton, and then runs to St. Botolph's. On the Walton branch there are connections with the three through Clacton trains, with a fourth trip in each direction for return working purposes.

Since this article was written most of the trains mentioned have been accelerated by a few minutes, the departures from, and arrivals in London, being as noted, with altered times on the Clacton and Walton branches, and intermediately. In May and June further improvements will be incorporated.

A few of the Clacton branch trains run through to Marks Tey and thence to Sudbury, and even to Cambridge or Bury St. Edmund's. Some of the stopping trains are, therefore, worked by main-line engines or by mixed-traffic locomotives of the "420" class. Others are taken by 2–4–2 tank engines, and the usual locomotive for the Brightlingsea service is a small 2–4–2 of the "1300" class.

On the Walton branch there are several odd runs to and from Thorpe-le-Soken, for the purpose of making connections in the opposite direction, and the ordinary branch engine—a 2–4–2 tank locomotive—is assisted by 0–6–0 goods tender engines, as there are too many services to be worked by one engine.

(To be continued.)



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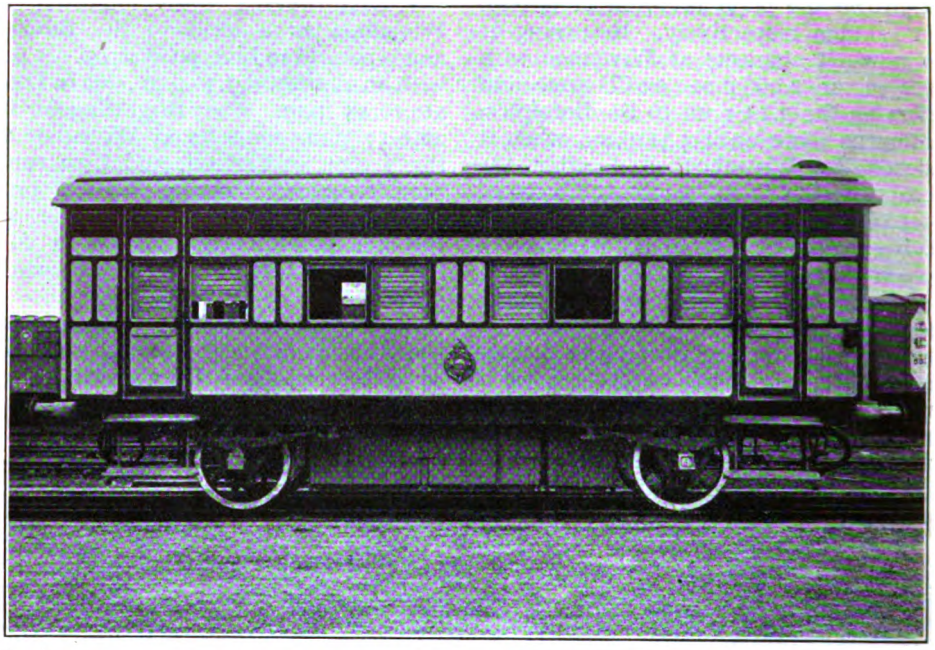

STANDARD TYPE OF OFFICERS' RESERVED SALOON, EASTERN BENGAL RAILWAY.

Kanchrapara Carriage and Wagon Works, Eastern Bengal Railway.

ADJACENT to the locomotive works but entirely separate therefrom, the carriage and wagon works of the Eastern Bengal (State) Railway, 5 ft. 6 in. gauge section, are situated at Kanchrapara. Prior to 1915-16 the locomotive and carriage and wagon works were combined on the site of the present locomotive works, but owing to the large increase in the rolling-stock the works were extremely congested, and it was decided to build entirely new and up-to-date carriage and wagon shops on land to the south of the old works, the situation being chosen to permit of practically unlimited extension to meet future requirements.

The area covered by the new works is approximately 58 acres, totally enclosed by an 8 ft. brick wall. The works consist of five main buildings: the body construction shop, the saw mill and the paint shop are brick structures with steel roofs, while the carriage repair shop and the machine shop are all steel buildings having corrugated iron sides. The roofs of all the buildings are of the saw-tooth type, arranged to provide the maximum amount of light with a minimum of sun-glare. All the shops have been planned so as to afford a high degree of comfort to the workmen; coolness and efficient ventilation have been given careful attention.

Proposed New Wagon Shop.

Owing to lack of funds the wagon repair yard is at present in the open, but plans and estimates have been prepared by the chief engineer of the railway for the construction of a commodious wagon shop in the existing wagon yard. This shop will consist of two 40-ft. spans 400 ft. long, having a 15-ton electric travelling crane in each bay. The building will be used for heavy repairs, and is designed to accommodate 40 standard 27 ft. 7 in. steel jute wagons or 60 ordinary wagons. It is also proposed to provide a light repair shed to take 50 jute wagons or 75 ordinary wagons

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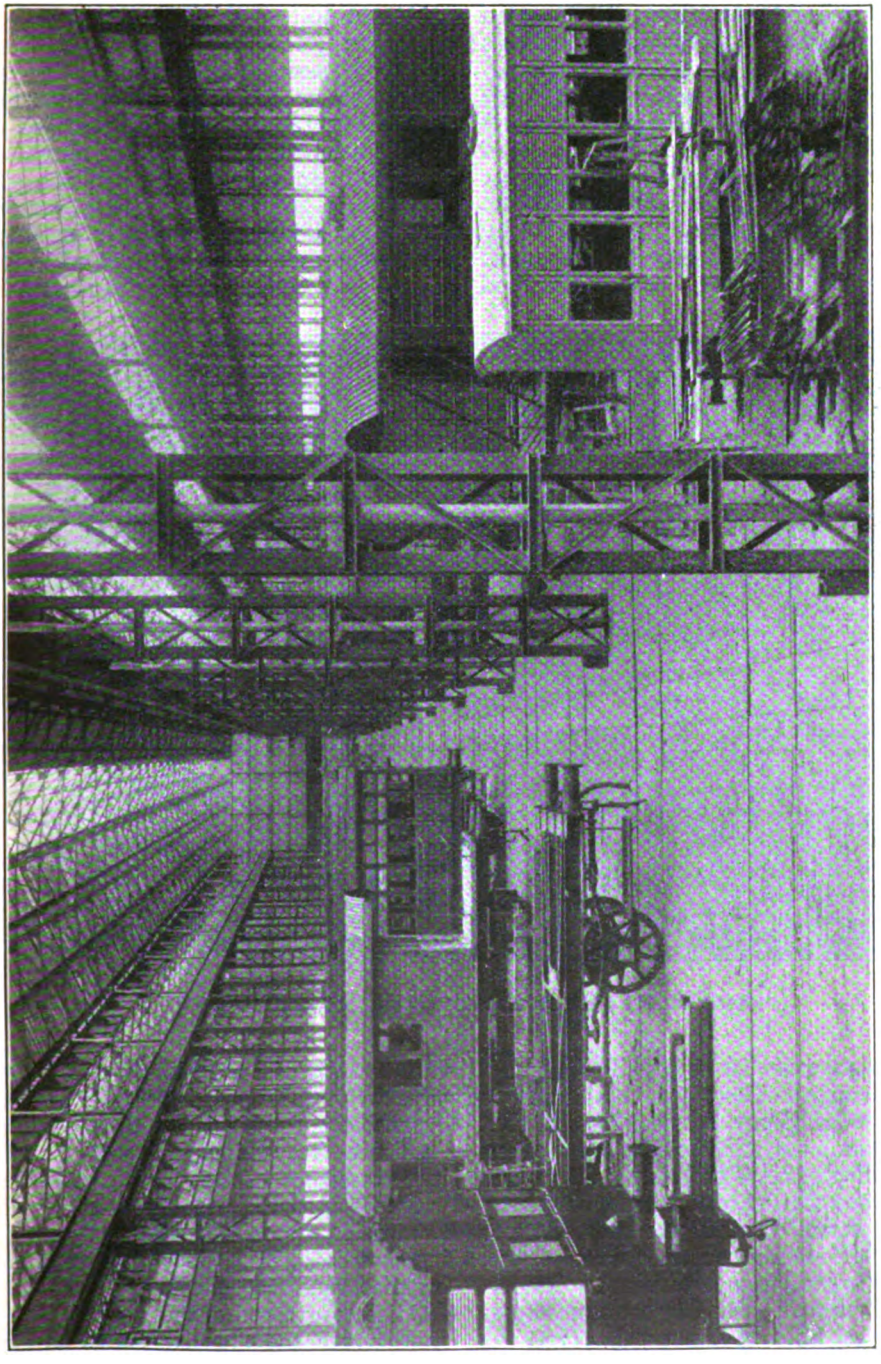

INTERIOR OF CARRIAGE REPAIR SHOP, KANCHRAPARA CARRIAGE AND WAGON WORKS, EASTERN BENGAL RAILWAY.

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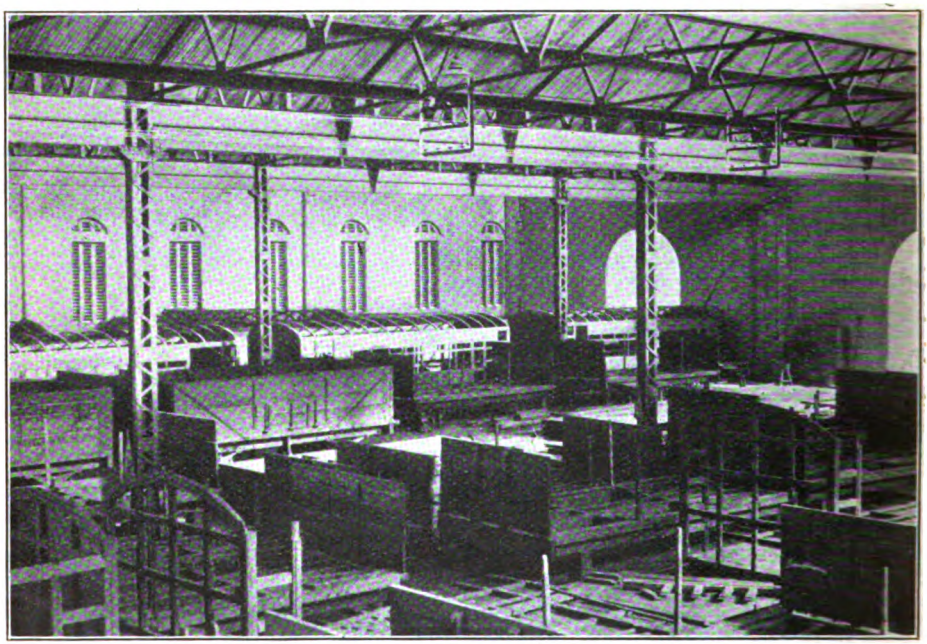
on the north side of the wagon shop traverser.

The main entrance gate of the works is on the north side, and there are situated the time offices and the works manager's office; these are accommodated in a handsome brick building lying in the cool shade of surrounding trees. Proceeding along the main roadway, along either side of which trees have been planted, the first shop to be entered is the body construction shop. This is at present 243 ft. long by 194 ft. wide, and consists of four bays; there are now three tracks in each bay, and the shop accommodates 33 5 ft. 6 in. gauge bogie carriage bodies; but in addition to all 5 ft. 6 in. gauge coaching stock, that for the metre and 2 ft. 6 in. gauge sections of the railway is now built in this shop, and it is proposed to extend it northwards by 100 per cent. Part of the west bay is given over to the construction of doors, windows, venetian and wire-gauze frames, &c., and adjoining this bay are store rooms for fittings, finished timber, &c., and the foreman's office. Timber from the saw mill enters this shop by means of a 2-ft. gauge trolly line, which conveniently connects up all the different shops.



A CORNER OF THE BODY CONSTRUCTION SHOP.

Modern Saw-Mill Equipment.

To the south of the construction shop lies the saw mill, which is one of the finest and most up-to-date in India. It is 480 ft. long by 157 ft. 3 in., and consists of three bays; the east bay is equipped with a 3-ton electric crane, which now runs out 400 ft. on a gantry into the timber store yard, and by means of which all logs are brought into the mill. In this bay are the log saws, including a 36-ft. horizontal log band-saw capable of taking logs up to 42 in. square. The writer saw this machine about to begin a cut on a 42-in. padouk square, which timber being of a rich, dark red colour and capable of taking an excellent polish, is extensively used for interior mouldings, furniture, &c. After having been cut up into scantlings in the east bay the timber proceeds into the other two bays, which are well equipped wtih circular saws, planing machines, vertical band-saws, moulding machines, &c.

At the north end of the mill (*i.e.*, the end from which the finished timber emerges) there is a panel-scraping machine, and a sand-papering machine for finishing carriage panels, matchboarding, &c., also a group of chain and hollow chisel morticing

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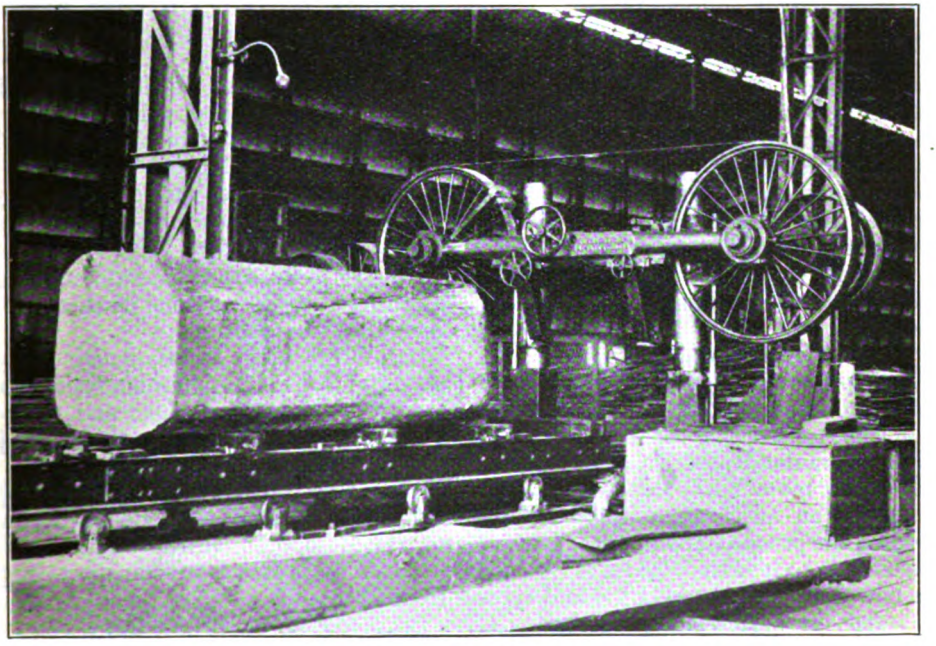
machines. One thing worthy of special mention is a dovetailing machine, which was installed during the war for the purpose of dovetailing shell boxes, in which the shells made in the locomotive works were despatched ; this machine is employed now in dovetailing the sides of battery boxes for the train-lighting department. Finished timber is stored in an enclosure 40 ft. long and extending the width of the saw mill at the north end from where it is issued to the shops as required. The floor of the mill is 8 ft. above ground level, and all the machines are driven by electric motors placed under this floor, the larger machines having independent motors and the smaller ones being "grouped" and driven by means of shafting, running at 450 r.p.m., in "Skefko" ball bearings. All shavings and saw dust are removed from the mill by suction through a system of piping under the floor, and exhausted through a "Cyclone" extractor, into trucks outside the boundary wall, being finally burnt under the boilers in the power house.



42-IN. LOG BAND SAW, WITH A PADOUK LOG ON TABLE.

Carriage Repair Shop.

The carriage repair shop is 680 ft. by 160 ft., and includes also the cabinet shop and the train lighting shop. It consists of four 40-ft. bays, of which the two northern bays are each provided with two 20-ton electric travelling cranes, the running rails for which are 22 ft. above the floor of the shop. By means of two of these cranes (one in each of the two adjacent bays) carriage bodies are lifted off their underframes for repairs, repairs to underframes being also attended to in this shop. The construction of the corrugated iron sides of this building is arranged to afford ample ventilation.

After being repaired, vehicles pass by means of a 65-ft. electric traverser into the paint shop, which is 600 ft. by 162 ft., and accommodates 44 bogie coaches. The tracks are extended 75 ft. outside the shop each side, on which the vehicles are run into the sun for drying. At the west end of the paint shop is the trimming shop, and at the east end, partitioned off by a brick wall, is the paint mixing department and paint stores.

Following painting, carriages are taken on the traverser and placed on the examination pit, which extends along the west end of the repair and machine shops ; this pit is 500 ft. long, and is fitted throughout

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its length with vacuum piping, having connections for the train pipes of vehicles at suitable intervals. Vacuum is created by an electrically-driven pump situated in the machine shop. Final examinations and testing completed, the coaching vehicles are run on to the weighbridge for re-taring, and leave the works at the south-west gate for a trial run on the main line before being passed to the traffic department.

Machine and Fitting Shops.

The machine, fitting and smiths' shops occupy a building of which the dimensions are 360 ft. by 129 ft., composed of three 43-ft. bays. This building will eventually house the machine and fitting shops only, the intention being to erect a separate smiths' shop. The northern bay is the wheel shop, and contains five heavy wheel lathes, each having its own 30-h.p. motor, and an additional 4½-h.p. motor for rapidly traversing the movable headstock. These machines are capable of taking a very heavy cut and profiling tools are used for the finishing cut, so that the average out-turn of each machine is five pairs of wheels in an eight-hour day. The wheel bay is served by an electric 3-ton travelling crane. In this bay there is an oil-fired tyre furnace, a pneumatic hammer for beading over the lips of tyres for securing the retaining rings, and a hydraulic wheel press having an independent motor; the latter machine is fitted with an autographic apparatus for recording the pressure at which each wheel is pressed on to its axle. Axles are turned on a new double-end axle lathe, and tyres are bored on a double head horizontal boring mill. All axle journals for both coaching and goods vehicles are ground and then cold-rolled, with a consequent saving of time and prolongation of the life of the axles.

Smiths' Shop.

In the smiths' shop there are 30 fires all fitted with a down draught system of smoke extraction. The equipment in this shop includes two compressed-air compound hammers of 7½ cwt. capacity, and a power-driven air hammer of 2¼ cwt. capacity. As there are two batteries of drop stamps in the locomotive works which are capable of meeting all the needs of the carriage and wagon department, it was unnecessary to instal drop hammers in the C. & W. smithy. The locomotive department also supply all castings, both iron and brass, and deal with the repair of carriage and wagon springs. An oxy-acetylene welding plant has recently been installed, and is proving of great value in the repairing of buffers, axleguards, &c. Compressed air at a pressure of 90 lb. per square inch is supplied to the compound hammers and to the numerous air lifts, riveting hammers, drilling machines, by a 500 cu. ft. vertical air compressor.

The wagon repair yard is divided into two parts by a 45-ft. electric traverser running down the centre of the yard. The average number of goods vehicles in the yard under repair at any one time is 350, and the monthly out-turn is in the neighbourhood of this figure.

During the war a considerable amount of munitions work was done in these works, including the following:—

(*a*) Fifty 4-ft. 8½-in. gauge wooden wagons for the Mesopotamian Railways.

(*b*) Six 4-ft. 8½-in. gauge and 13 metre gauge cold storage vans to the designs prepared by Mr. W. F. Harnett, C.B.E., the Locomotive, Carriage and Wagon Superintendent of the Eastern Bengal Railway, for the Mesopotamian Railways.

(*c*) A large batch of transport wagons (road).

Future Extensions.

The shops are capable of being largely extended in the future if this is found to be necessary; the body construction shop can be extended northwards, the saw mill southwards, the paint shop to the south or west, the carriage repair shop to the north and west, and the machine shop southwards and westwards; moreover, there is ample ground available to the west for extending the works area should that at any time become unavoidable.

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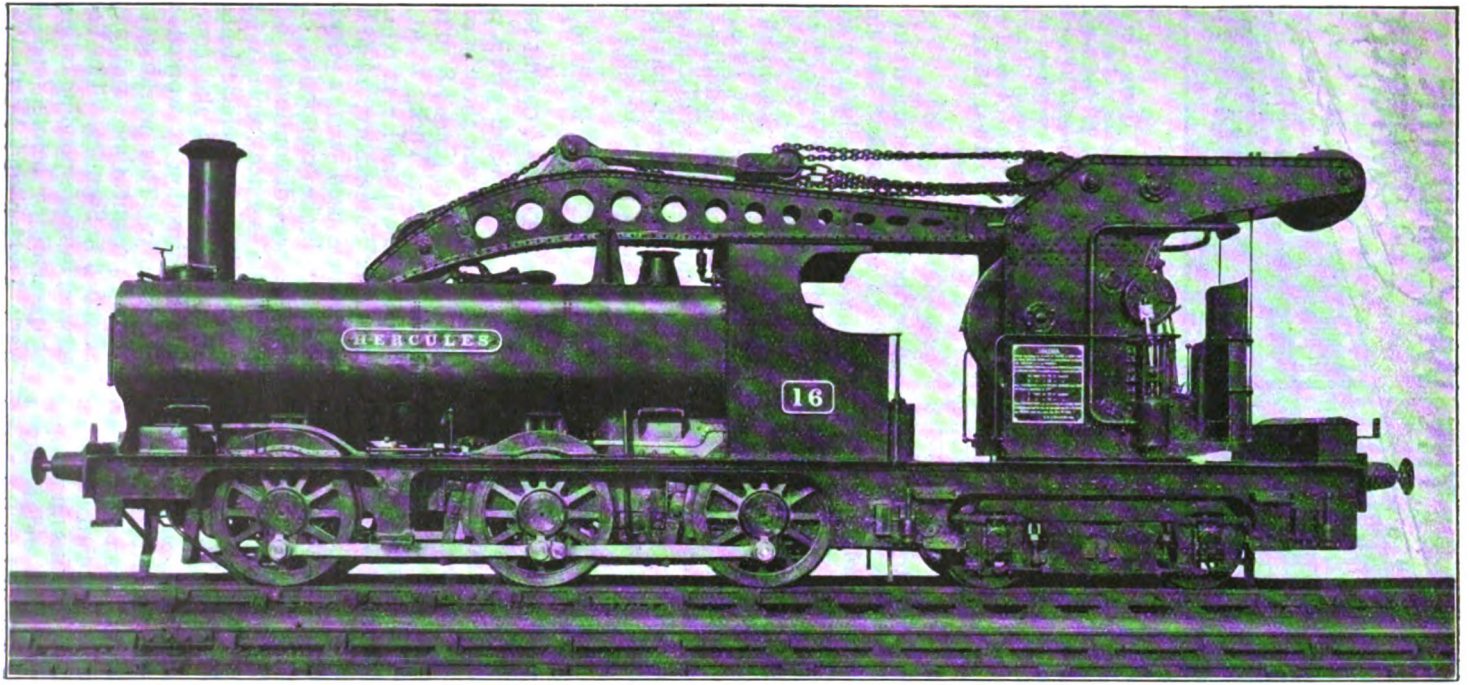
COMBINED LOCOMOTIVE AND CRANE, GREAT WESTERN RAILWAY, RECENTLY CONSTRUCTED AT SWINDON WORKS.



[*By courtesy, "Great Western Railway Magazine."*]

Cylinders	... ...	16 in. by 24 in.	
Coupled wheels	... ...	4 ft. 1½ in. diam.	
Trailing bogie wheels	.. ..	2 ft. 8 in. diam.	
Steam pressure	... ...	165 lb. per sq. in.	
Heating surface	... ...	980·75 sq. ft.	
Water capacity of tank	... ...	1,200 galls.	
Crane load	... ...	6 tons at 18 ft. radius (double chain), 9 tons at 12 ft. radius (treble chain).	

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RAILWAY MAGAZINE readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to the dimensions and weights of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. No reader should send more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history and the like, the pages of the "Railway Year Book" should be consulted. The twenty-fifth Annual Edition of this standard railway reference work is on sale at 5s. net, or by post, from the RAILWAY MAGAZINE Offices, 33, Tothill Street, Westminster, London, S.W.1, to any part of the world, 5s. 9d.

Collapse of Bridge, Coventry-Leamington Section, London & North Western Railway.

Mr. H. M. Comber kindly writes:—"The following extract from Neele's Railway Reminiscences may be of interest:—'10th June, 1861. Received a wire announcing that bridge carrying line over cross roads at Leek Wooton on Coventry, Leamington and Kenilworth line had fallen in, the Driver and Fireman of the Goods Engine under which the Bridge had collapsed were both killed. The line between Kenilworth and Milverton (Single) was broken through and High Road underneath quite blockaded. Arrangements made to carry traffic from Leamington on one side and Kenilworth on the other. It was five days before road was reinstated for traffic. The inquest was twice adjourned. . ... The heavy engine had found a weak place in the Bridge where a crack in the iron plating had been attempted to be strengthened by fish-plates, and the engineers in charge had a very uncomfortable time in prospect of the verdict.'"

[Further reply to G. W. BISHOP.]

The Northern Counties Union Railway.

This company was formed in 1846 for constructing railways from Wath to Bedale, and thence to Barnard Castle on to Tebay. Parts of the line in various districts were constructed and finally a section of 2¼ miles was sold to the North Eastern Railway. A considerable amount of capital, £4 in all out of each £10 share subscribed, was returned to the shareholders as dividends. The final meeting of the company was held on February 28, 1860, when the chairman announced that the amount returned to the shareholders on that date would use up all funds with the exception of about £500, which was retained to meet any liabilities they might have incurred and not discharged. At this meeting it was agreed that the company should lapse, so as to save the expense of winding it up.

[Reply to M. E. B.]

Through Coaches, Cardiff-Newcastle.

Mr. A. S. J. Walsh writes pointing out that before the war there was a through coach, run on the 7.8 p.m. ex-Newcastle (9.35 ex York, 10.40 ex Leeds, 1.35 ex Crewe), and 7.42 p.m. ex Cardiff (10.50 ex Shrewsbury, 12.40 ex Crewe); the vehicle used was a Great Western Railway brake composite. During the war this was discontinued, but a Crewe-Newcastle service replaced it on the same trains, the vehicle being a North Eastern Railway brake composite; in the up direction it worked through to Shrewsbury. This working is unaltered at the present time, and has not been extended to Swansea. The York-Swansea service, by corresponding trains, is running at present, as before (and during) the war; London and North Western Railway stock is always used on this service.

[Further reply to "BOLTONIAN."]

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Locomotive Notation.

Of the three figures employed in the wheel notation of locomotives of ordinary design the first indicates the number of carrying or idle wheels at the leading end, the second the number of coupled or driving wheels, and the third the number of idle wheels at the trailing or firebox end of the engine. Where there are no wheels corresponding to the first or last of these descriptions as, for example, at the firebox end of a six-coupled bogie express engine of, say, the Great Western Railway "Star" class, a cipher takes the place of the number, notation in this case being "4-6-0." More complex designs, such as Garrett engines or Mallet compounds, require a more complicated notation, into which we have not space to enter here.

[Reply to S. ALVAN.]

Train Resistance.

It would require much space adequately to deal with your query. The formula you mention is but one of many which have been devised to arrive at this very variable quantity, and you are right in assuming that differences must be made in respect of locomotives, passenger stock, goods stock, &c. This matter has been dealt with at considerable length by Mr. Cecil J. Allen in his RAILWAY MAGAZINE articles from last October onwards, and we believe it is his intention further to develop it in future contributions, when doubtless you will obtain the detailed information you need.

[Reply to "FRIAR."]

Royal Wedding Train.

Engine used on February 28 was No. 4048, named in the ordinary way *Princess Victoria*, but it was altered to *Princess Mary*. The engineman was R. Wiggins, and the fireman A. E. Brenton, both of Wolverhampton. Chief Locomotive Inspector G. H. Flewellen also rode upon the engine, and Mr. J. R. Yule, Mechanical Inspector and Mr. J. Canell, Brake Inspector, travelled in the train. The latter three are stationed at Swindon. Mr. W. Thomas who was with the train is a Traffic Department Inspector.

[Reply to C. WADDELL.]

Maximum "Official" Speeds.

We do not know in what sense you use the word "official"; if you mean authentic the late Mr. C. Rous-Marten recorded a speed of 102·3 m.p.h. in the descent of Wellington Bank, near Taunton, Great Western Railway, and 96 m.p.h. in descending from Blea Moor towards Hellifield, Midland Railway. We know of no corresponding figure on the North Eastern Railway, which has few, if any gradients of suitable length and alignment for the development of such tremendous speeds.

[Reply to A. R. HARRISON.]

Tunnels on Midland Railway.

Five longest are Totley (3 miles 950 yards) and Cowburn (2 miles 182 yards), between Dore and Chinley; Disley (2 miles 346 yards), between Cheadle Heath and Chinley and Dove Holes (1 mile 1,224 yards) between Chinley and Peak Forest; and Blea Moor (1 mile 629 yards), between between Hawes Junction and Settle. Look in the RAILWAY YEAR BOOK for further information of this character.

[Reply to "MIDLANDER."]

Indicators on Great Western Railway Locomotive Cabs.

The coloured discs and letters which you have noted on the cabs of Great Western Railway Locomotives have already been explained in the RAILWAY MAGAZINE. Their general purpose is to show the sections of the system on which the engines concerned are allowed to travel, where weight and other considerations limit the working of the larger engines.

[Reply to D. W. PUGH.]

0-4-4 Tank Engine "Longmoor."

Built at Swindon in January, 1890, as a 0-4-2 tank engine it was then numbered 34. Rebuilt in October, 1895, as a 0-4-4 tank engine, during the war it was utilised for camp railway purposes. It is now employed on the military railway at Longmoor Camp. When seen by you probably it had been sent to Swindon for repairs.

[Reply to "THE TRIO."]

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Barnsley and the Hull and Barnsley Railway.

The connection between this railway and the town of Barnsley concerns goods and mineral working only, and not passenger traffic; we are not aware that this company ever worked passenger trains into Barnsley. The two train services you mention were suspended during the war.

[Reply to "WAVERLEY."]

Shropshire and Montgomeryshire Railway Engines.

The locomotive stock consists of three 16-in. 0-6-0 tender engines, built by Beyer, Peacock & Co., one old Bury 0-4-2 tank engine, one Manning Wardle & Co.'s 12-in 0-6-0 tank engine, and one 5-in. 0-4-2 tank engine running a tramcar, six in all.

[Reply to R. A. WHEELER.]

Railway Accidents.

The most serious accident on a British railway was that at Quintinshill, Caledonian Railway, on May 22, 1915, when 227 persons, chiefly soldiers, were killed in a troop train collision. We do not possess records of all accidents that have taken place on foreign railways.

[Reply to T. W. LINSELL.]

Highest Speeds.

Highest speed authentically recorded on a British railway was attained on May 9, 1904, when the Great Western Railway 4-4-0 engine, *City of Truro*, reached a speed of 102·3 m.p.h. while descending Wellington Bank with an Ocean Mail special.

[Reply to W. P. PORTER.]

Railway Year Book.

This standard railway reference work was first published in 1898 so that the issue for 1922 is the twenty-fifth annual edition. All the information you require can be gleaned by going through the editions 1910 to 1922 inclusive.

[Reply to C. KAILE.]

Engine Depôts, Great Eastern Railway.

Particulars are included, as in the case of many other railways, in the RAILWAY YEAR BOOK. We are not aware of any special speed record to the credit of a particular Great Eastern Railway locomotive.

[Reply to P. D. MORRIS.]

Wood Centre Wheels and Track Circuit.

The difficulty is usually overcome by providing a sufficient conductor between the wheel rim and the axle to allow for track circuit requirements in the case of wood centre wheels.

[Reply to H. C. B. HILL.]

Tractive Effort.

This term was defined on page 201, March, 1922. Tractive effort, at 80 per cent. working pressure, of Great Central Railway 0-8-4 three-cylinder shunting tank engines is 36,100 lb.

[Reply to "ATTRACTIVE" and "MOGUL."]

Isle of Wight Railways.

For particulars of tours please communicate direct with Frame's Travel Agency, 92, Southampton Row, London, W.C.1. This firm arranges hotel accommodation.

[Reply to "LITTLE BEAR."]

Dumfries Gas Works Siding.

Chains in the grooves of the railway through the public street into the gas works are laid to prevent wheels of road vehicles from getting jammed.

[Reply to R. G.]

Hump Marshalling Yards.

See "Railway Year Book," 1922, page 57.

[Reply to S. T. P.]

Non-Stop Trains at Oxford.

See public time-tables.

[Reply to T. A. LITTLE.]

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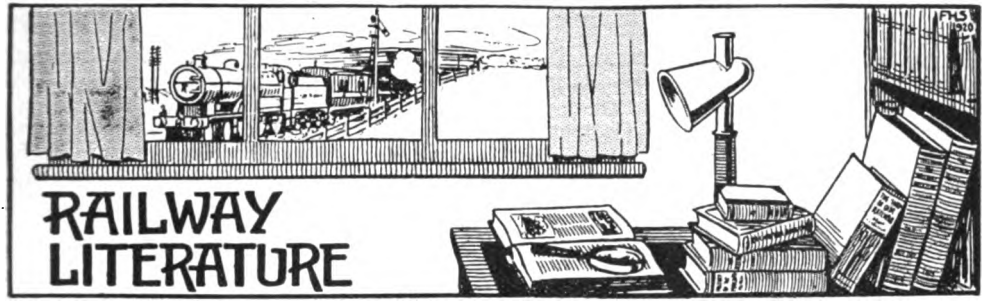

THE RAILWAY YEAR BOOK FOR 1922. (London: 33, Tothill Street, Westminster, S.W.1. Price 5s. net. By post 5s. 9d.)

Year by year this standard railway reference work makes its appearance as soon as possible after the final figures for the previous twelve months are available, and as this is the twenty-fifth occasion that an annual edition of the book has been produced there are not a few subscribers so accustomed to consulting its columns, they would miss it sorely were they deprived of the vast store of valuable railway information contained in its upward of 400 pages.

In addition to railway shareholders who from it gather facts and figures concerning their properties there is the great army of railway directors, officers and general railway staffs who regard the book as an indispensable *vade mecum* for office use. Others there are such as engineers, manufacturers, civil servants, military men, and politicians, to say nothing of that great class in the community consisting of persons, who, although not in railway employment, study all questions relating thereto with intelligence and zeal; these and many others welcome the advent of a new issue of the *Railway Year Book*, and willingly subscribe to the appropriateness of its sub-title "The Whitaker of the Railway World."

The book under review has been produced during a period when great changes in the constitution of British railways have been in a state of development and it is published at a time when the conduct of the arrangements for the future of the iron-roads of our land is in its most critical stage.

As required by the Railways Act, 1921, all standard railways in Great Britain are to be amalgamated into four grouped systems, and throughout the year 1922 the complex and difficult problems thereby involved will be occupying the minds and absorbing the attention of railway directorates, railway officers and the railway world in general. Manufacturers, traders and all users of the railways, likewise have a close concern in all these matters, and in compiling the present edition of the *Railway Year Book*, the requirements of subscribers outside the railway world as well as of those within its borders have been carefully borne in mind.

In the book for 1922, there is a very complete summary of the provisions of the Railways Act, 1921, of the Railway Wages Boards and Councils, a table showing the allocation of the first instalment of the £60,000,000 constituting the agreed settlement of railway companies' claims against the Government, and other sections incident upon the current railway situation.

Particulars are included of amalgamations already in an advanced state, while a new article, illustrated by a new map, describes the London and North Western Railway as it is to-day, following its absorption of the Lancashire and Yorkshire Railway, as from January 1, 1922.

Among new features, as distinct from the standard sections of former years, may be mentioned an extended review of the progress of electric traction in Great Britain, tables showing the numbers of employees on each railway and of each grade, more complete particulars in regard to power and automatic signalling and facts concerning oil-burning on locomotives.

The pages devoted to railway institutions, associations and societies are as extensive as ever, while those set apart for oversea railways are not the least valuable portion of the book. Personal paragraphs in the form of biographical notes concerning the leading officers in the services of British and Irish railways form a feature that should prove of value to many. The changes that have taken place since the book for 1921 was published are very considerable.

Without the cordial co-operation and assistance of leading railway officers, both at home and abroad, it would be impossible to produce a reference work of the character and of the scope of the *Railway Year Book*, and we are pleased to notice this fact is not overlooked by the compilers, for suitable acknowledgment is made in the preface of the valuable aid rendered by the officers in question. These thanks, we are sure, the annual subscribers to the book will fully endorse.

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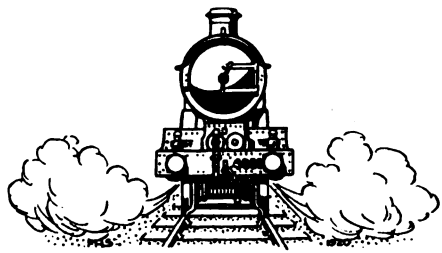
LECTURES ON THE LOCOMOTIVE. [By Dugald Drummond, M.I.C.E., with supplementary lectures by R. W. Urie, M.I.Mech.E., London: Locomotive Publishing Company, Limited, 3, Amen Corner, E.C. Price 3*s.* 6*d.* net.]

This is the sixth edition of a recognised "best seller" among locomotive books. The original lectures were given by the late Mr. Dugald Drummond when Chief Mechanical Engineer to the London and South Western Railway, and they were set forth in language and in terms easily understandable by persons of ordinary elementary education. The book is adequately illustrated. To the late Mr. Drummond's are added very useful chapters by the present Chief Mechanical Engineer, Mr. R. W. Urie, entitled "Notes on the 'Eastleigh' Superheater," "Cylinders with Piston Valves," "The Lubrication of Cylinders and Slide Valves," and "The Walschaert Valve Gear," also notes on "Electricity for Enginemen." Mr. Urie's portion of the book is illustrated by drawings which refer to the latest types of locomotives on the London and South Western Railway designed and constructed since Mr. Drummond's day. The book is sold for the benefit of the London and South Western Railway Servants' Orphanage, and is in stock at the offices of THE RAILWAY MAGAZINE. By post the price is 3*s.* 8*d.*

A REGISTER OF ALL THE LOCOMOTIVES NOW IN USE ON THE LONDON AND NORTH WESTERN RAILWAY. (Compiled by C. Williams and published at 73, Chetwode Street, Crewe. Price 3s. 6d. net.)

In his preface to this careful compilation, Mr. Williams expresses the thought that a new and amplified register of London and North Western locomotives might be welcomed by the large body of enthusiasts who find pleasure and recreation in all appertaining to the numbers, names, dates and classes of the locomotives belonging to our premier railway company. In this he is not likely to be mistaken for the compilation undoubtedly fills a long-felt want. The Register, which consists of 96 pages, includes all locomotives owned by the London and North Western Railway on December 31, 1921, and agrees with the company's official return of locomotive stock as on that date, the only difference between the two being that the departmental engines, 37 in number, are as a rule omitted from the latter, 18 of which carry numbers in the duplicate list. In issuing his list, Mr. Williams expresses his appreciation of the assistance he has received from Mr. H. P. M. Beames, of Crewe Works.

From the book, which is not illustrated, will be gleaned the following facts:—The total locomotive stock of the London and North Western Railway now stands at 3,373 (2,254 tender and 1,119 tank), a higher total than has been reached before, comprised in 43 different classes, of which 795 are superheated, and 658 bear names, these figures not including the seven narrow-gauge engines used in Crewe Works, nor the six engines of the Dundalk, Newry and Greenore Railway, particulars of which Mr. Williams has included for the first time. The book contains a printed inset giving on one side a table of classes of passenger engines and on the other similar particulars as to goods engine classes. In addition to types the tables provide particulars of cylinders, boiler pressure, total heating surface, number of locomotives in each class and there is a column of remarks apposite to the various types.



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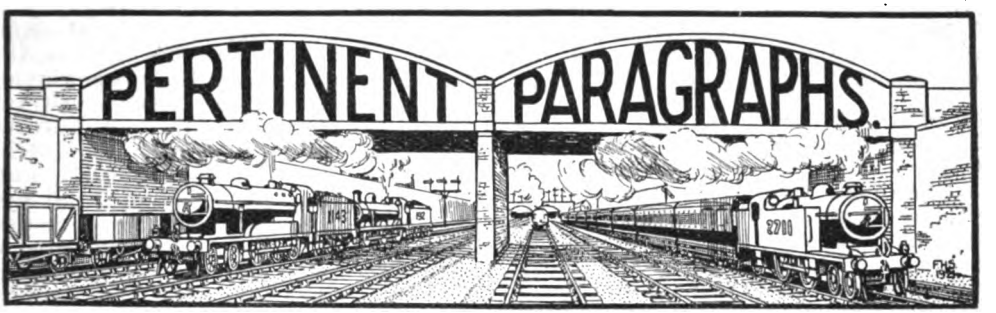

The Railway Magazine 300th Number.

ONE of the principal features of the Victorian age was the marvellous development of railways, not alone in the British Isles, but throughout the civilised world, and it was a fitting climax to such a period that within less than half a decade of its termination the RAILWAY MAGAZINE was founded. The first issue was dated July, 1897, and as a consequence the forthcoming number for June, 1922, will complete twenty-five years consecutive publishing. No. 100 was that for October, 1905, No. 200 appeared in February, 1914, six months before the commencement of the Great War —and now we are about to complete our third century.

The unqualified success that has attended the publication of the RAILWAY MAGAZINE from its inauguration in 1897 down to this year of grace, 1922, is a sufficient justification for its continued existence and it proves beyond all question the claim that it meets the wants and gratifies the wishes of those who desire an authoritative railway monthly periodical, well-illustrated, and at the same time reliable, instructive and ever of real live interest. To produce such a magazine has been at all times since its inception, the aim and the object of the proprietors and the world-wide circulation coupled with the freely-expressed approval of a multitude of readers that has followed in the wake of their activities for the past twenty-five years may be taken as ample evidence that they have not failed.

For nearly twelve months letters have reached the RAILWAY MAGAZINE from well-wishers at home and abroad making inquiries or framing suggestions concerning the 300th number. Needless to say we have been able to assure all such anxious readers that the event would not be overlooked, and that special efforts would be made to produce a notable number to celebrate the auspicious occasion they had in mind.

During the war we were compelled from time to time to take our readers into our confidence in regard to the difficulties of publishing. Paper rationing and scarcity, soaring printing prices, increased illustration costs, curtailed transport and facilities generally made the period when half the world was in arms, one of unparalleled perplexity, but with the loyal support of the vast majority of the great army of RAILWAY MAGAZINE readers we were able to surmount the embarrassments and obstacles we had to encounter from month to month. Many of our keenest readers, alas! were called upon to make the supreme sacrifice in the war for freedom, but their places have been taken by the oncoming generation, and so the continued progress of the RAILWAY MAGAZINE is assured.

Some of our older readers write, now and again, to ascertain what prospect there is of the magazine being published at its pre-war price, and their letters are received with the courtesy and the consideration the views and opinions of long-standing supporters deserve, but we have to point out that production costs, even in view of the recent falls in the price of paper, still average more than three times what they did eight years ago! This circumstance precludes the possibility of producing a satisfactory periodical at a pre-war price.

On the other hand, a larger number of readers by their communications urge us not to reduce our price, but if, and when, production cheapens to give the purchaser more for his money. At the moment we are inclined to agree that this is the better plan.

In the meantime it is our intention to make the 300th number, not only larger in bulk, by including additional pages, but likewise to cause it to be of outstanding value and attractiveness by the merits of the contributions and the illustrations it will contain.

For the 300th (June) number a much larger demand than usual is anticipated, and although we shall print extra copies, it will be well for each reader who has not placed a standing order with a bookseller or a newsagent to do so on this occasion, so that he may not be disappointed.

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In conclusion, may we thank the writers of the many congratulatory letters already received concerning the coming of our 300th number?

Our May Frontispiece.

IN connection with the opening article of this month's RAILWAY MAGAZINE, the frontispiece illustrates the northern entrance to the new London terminus of the London and South Western Railway, commonly known as Waterloo Station. Advantage was taken of the work of reconstruction to introduce a memorial to the employees of the railway in question who gave their lives for King and country in the Great War, and it will be admitted that this memorial is one of the most remarkable in Great Britain. It is known as the "Victory Arch."

The frontage is slightly set back from the general line, and approached by a handsome flight of stone steps, is a finely-proportioned but massive arch in Portland stone with a span of 28 ft. The sculptural decorations are three groups, two of which are semi-circular in composition, placed on the pylons either side of the arch. The one on the left, representing War, 1914, has a central figure of Bellona, Goddess of War, wild and distraught, clad in scaled armour, astride the world, with a flaming torch and naked sword dealing death and destruction. The other on the right, representing Peace, 1919, has for its motive a figure of Peace seated and enthroned upon earth, and holding a palm branch and a small figure of winged victory, symbolical of Peace and Victory, bringing abundance and contentment, whilst commerce and liberal arts flourish, the panel round the arch being decorated with war trophies, and discs giving the different countries where British soldiers have fought, the whole surmounted and finished by the central group of Britannia, seated and triumphant, holding aloft the sacred torch of Liberty to her own greatness and glory, and for the guidance of mankind in general. Under the arch, on either side on bronze tablets, the names of the 585 London and South Western fallen heroes are inscribed.

Observers of the general effect of this magnificent "Victory Arch" are impressed by the correctness of its proportions. It reflects credit on all concerned. but particularly Mr. J. R. Scott, Chief Architectural Assistant to the Chief Engineer.

Checked Baggage on the London and South Western Railway.

IN order to relieve passengers of the expense and difficulties connected with the conveyance of luggage between their homes or hotels and railway stations, and to avoid the responsibility for personally supervising the despatch, transhipment *en route*, and delivery of their luggage at destination, the London & South Western Railway has introduced a checked baggage system which has many points of novelty and includes features of interest to all traffic officers. The system avoids formalities as far as possible, and there are no consignment notes to fill up. It provides for the transit of luggage under three conditions:—(*a*) collection and delivery only; (*b*) collection and conveyance to destination station only, and (*c*) conveyance and delivery only. In each case a charge of 1s. is made, but otherwise, except that passengers are required to produce tickets (which can be obtained in advance according to usual arrangements) for the journey involved, and that transit is subject to the usual excess charges beyond the authorised free allowances, no further expense is involved.

A system of numbered checks or labels is used, six variations being employed, rendered distinctive by colour and marking, to meet the various conditions. In each case the duplicate portion is retained by the passenger after the original has been attached to the luggage by the carman or station staff. Checks covering excess charges have a triplicate portion, with a green bar indicating that such charges have been prepaid, or a red bar to indicate that excess charges are due for collection. The arrangement applies to passengers holding ordinary, season, tourist, excursion (other than day or half-day), week-end and privilege tickets, and applies to all classes of accompanied luggage, including cycles (not motor), mailcarts, &c., golf clubs, cricket bags, and commercial travellers' luggage, subject to the payment of the usual charges where they do not rank as authorised free allowance or are in excess thereof. The system covers various other conditions, and, while it possesses convenience from the company's point of view, it will undoubtedly prove of great value to passengers.

British Railway Amalgamations.

THE Railways Amalgamation Tribunal set up under the Railways Act, 1921, is getting busy. The first scheme to be laid before it was that for the amalgamation with the Great Western Railway of the Cambrian, the Cardiff, the Rhymney and the Taff Vale Railways, and also the Alexandra (Newport and South Wales) Docks and Railway. This was approved as from March 25, 1922. Since that date the proprietors and debenture stockholders of the Great Western Railway have approved of a preliminary scheme for the amalgamation with the Barry Railway, and also a pre-

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liminary scheme for the absorption of the Cleobury Mortimer & Ditton Priors Light Railway Company, the Penarth Harbour Dock & Railway Company, Port Talbot Railway & Docks Company, the Princetown Railway Company, and the Rhondda & Swansea Bay Railway. Under the schemes the amalgamation of the Barry and the vesting of the other five companies will take effect as from January 1, 1922.

At the Great Western Railway special general meeting, Viscount Churchill, who presided, referring to the absorption of the five subsidiary companies above mentioned, said, with regard to the Port Talbot Railway & Docks and the Rhondda & Swansea Bay Railway, their dividends were already practically secured by the Great Western, so that it would only mean the capitalisation of their existing liabilities in Great Western stocks. The Princetown Railway was worked by the Great Western, and the whole of the capital, with the exception of a small amount of ordinary stock, was owned by the Great Western, and that ordinary stock was being arranged for by a small cash payment. The Penarth Harbour Dock & Railway was leased by the Taff Vale Railway, and as that company had become amalgamated with the Great Western under their first scheme, the stock to be issued in exchange for the Penarth stock would merely be a capitalisation of their existing liability. The Cleobury Mortimer & Ditton Priors Light Railway was a light railway in Shropshire, and that was only a small transaction.

On March 27, the Railways Amalgamation Tribunal confirmed the union of the North Eastern and Hull & Barnsley Railways. The new North Eastern Railway came into being on April 1, 1922, with a capital of £89,899,455, and the total length of single track, including sidings, represented in the amalgamation is 5,370 miles. The Hull Dock Joint Committee is also absorbed in the new undertaking. Of course, the amalgamation of the North Eastern and Hull & Barnsley Railways is but the first step under the Railways Act, 1921, in the formation of the North Eastern, Eastern and East Scottish group of railways, the negotiations in connection with which will probably be facilitated by the prompt passage of the preliminary proposal.

When, on St. Patrick's Day, the announcement was made that a provisional agreement had been arrived at for the amalgamation of the London & North Western Railway (which has included the Lancashire & Yorkshire Railway since January 1, 1922) and the Midland Railway, there was great surprise in many quarters, as it was not generally believed that the negotiations could be brought to such an issue in so short a time. Disappointment there was, too, among those who were hoping that a separate Midland group might be formed, with headquarters at Derby. Under the provisional agreement the two undertakings will be amalgamated as from January 1, 1923, into a new company, the name of which will be subsequently announced. During 1922 the two companies will continue under separate management, but will work in the closest co-operation with a view to economy and with the object of facilitating the approaching amalgamation. The new board will consist of twelve London & North Western directors, eight of the Midland Railway, which will leave room for eight directors for the rest of the group. Much interest is being taken in the prospective title of the entire amalgamation when it comes into being.

100 Miles an Hour on the Croydon Atmospheric Railway.

A READER sends a newspaper cutting of a lecture given by a Mr. C. C. Fagg recently before the Croydon Natural History and Scientific Society. "Mr. Fagg obtained his information from that excellent description of 'The Old Croydon Tramroad, Canal and Railway,' compiled by Mr. W. C. Berwick Sayers, the Chief Librarian, and in this Mr. Sayers gives an account of the project in 1802 of the Grand Surrey Iron Railway which ran from Wandsworth across Mitcham Common on to Carshalton, and then across the Common again to its terminus in a field at West Croydon, on almost the same spot where West Croydon station now stands. This was really a tramway, for the trucks were drawn by horses, and it was the first of its kind in England for the public conveyance of goods. In 1810 there was another line down Tamworth Road, crossing Church Street, along Church Road, which was then known as Tramway Road, through some fields now Southbridge Road and running on an embankment and through a cutting by the side of the Brighton Road to Merstham and Bletchingley."

The lecturer also dealt with the original London and Croydon Railway, opened in 1839, from Tooley Street to West Croydon, and running for part of its length on the bed of the old Croydon Canal. "It was on this line that the application of atmospheric pressure was utilised to run the trains, and some of the incidents connected with that are interesting. Owing to the steep incline the trains, if such they can be called, never ran beyond Forest Hill, but the speed from Forest Hill to Croydon was enormous, even for these days of quick travel by airplane. Occasionally, however, the power was not

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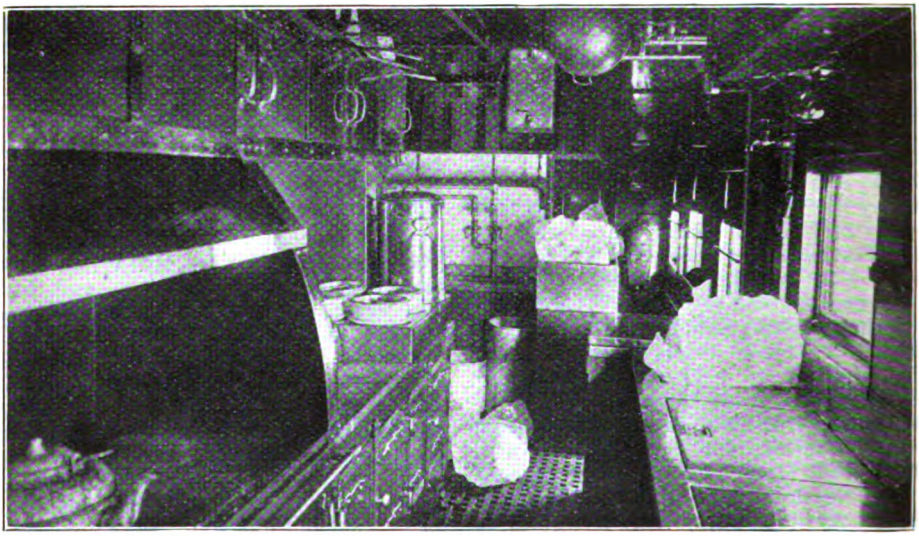
sufficient to take the train over the bridge at Norwood Junction, and the train would stop near the top. A simple process was adopted. The two front carriages were run over the bridge and the remaining carriages linked up to them by a rope, the momentum on the incline enabling the two first carriages to pull the others over. It was no uncommon occurrence for a train to arrive at Croydon in two parts, the front part towing the back part by a rope!"

Mr. Fagg also quoted the statement that on this atmospheric line very high speed was attained between Forest Hill and West Croydon, this distance being covered in 2 min. 47 sec. at the rate of 100 miles an hour! We do not recollect having come across this assertion before—certainly it must be taken with a very large grain of salt, and this would apply equally were it suggested that a train running away down the incline from Forest Hill once attained such a speed.

A Miniature Hotel Kitchen on Wheels.

VERY few women care for mechanical devices, as such, or take concern in railway equipment, but there is not in all the British Empire a housewife who would fail to be interested in the kitchen of one of the new up-to-the-minute steel dining cars that are every day moving to and fro across Canada. The kitchenette of the modern flat is often ingeniously planned, but ingenuity could meet with no more trying task than the putting of a complete hotel kitchen into the space afforded by a comparatively small compartment in a railroad car. The traveller to-day expects to find on the railroad car almost anything in the way of food that his fancy may dictate, and he demands it served in as perfect a manner as in a first-class hotel. That is why the hotel kitchen must be condensed into the dining car. A glance into this kitchen will at once show how ingeniously this has been done, and with what regard for 100 per cent. efficiency and the most perfect cleanliness. Ranges, refrigerators, and cooking utensils reflect the lights in their polished nickel surfaces, and ready to hand, in its well-appointed place, is everything in the way of an aid to cooking that the experienced chef may require.

What these miniature hotel kitchens



INTERIOR OF KITCHEN COMPARTMENT, C.P.R. DINING CAR.

can do may be gathered from the fact that in the course of a journey from Montreal to Vancouver 11 meals are served en route, and these to an average of 100 persons per meal. There are long stretches during this run when it is impossible to obtain supplies, so the superintendent must see to it that the ice-boxes and larders of each diner are stocked to satisfy the capricious appetites of the travellers it serves.

The importance of this branch of a big railroad may be gathered from the fact that the Canadian Pacific Railway has in daily use 150 dining, café and buffet cars, a larger number than operated by any other railroad in the world. The department also looks after the lunch counters, and dining rooms scattered over its 19,000 miles of rail and to serve the three and a-half million

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meals that are yearly partaken of by travellers on this road, requires the effort of 1,500 stewards, cooks, waiters and other operatives. To serve this large number of meals requires the yearly consumption of the following quantities of supplies :—

Fish	285,000 lb.
Beef	781,529 ,,
Poultry	473,612 ,,
Ham and Bacon ..	478,810 ,,
Butter	343,910 ,,
Tea	101,090 ,,
Potatoes	1,750,000 ,,
Eggs	3,529,800 only
Oranges	306,000 only
Cream	407,280 quarts
Coffee	282,540 lb.
Apples	324,820 ,,
Milk	799,560 quarts
Bread	860,398 loaves

Italy's Railways Under State Management.

AFTER an interval of twelve years, the International Railway Association is opening —as we go to press—its Congress at Rome. Italian railway affairs are therefore at the moment of special interest.

Careful consideration of State Railway Management as in vogue in this southern European country has resulted in the following summary :—

Italy has gained from State management the extension of railway lines and their adequate equipment in a manner that could not have been realised under private control, no matter how enterprising the directorates of the railways may have been. Lines have been constructed and services inaugurated that, left to private undertaking, would not have been established, for the simple reason that, however much such railways may be able to contribute to public convenience and to national prosperity, their chances, as commercial concerns, of paying their respective ways, to say nothing of ever becoming dividend-paying corporations, are exceedingly remote. It must, however, be admitted that the taxpayers have very heavy railway deficits to meet.

Political pressure upon the State management has compelled the railways to purchase most of their requirements from Italian manufacturers, even when prices are higher than foreign charges and although the national industry is already favoured with a high protective Customs tariff. Further, a considerable tonnage of merchandise is conveyed at unremunerative rates as the outcome of political action. This is particularly the case in regard to farm produce and flowers consigned to destinations beyond the northern frontiers. Import rates do not enjoy a similar solicitude on the part of the powers that be.

In Italy, to a greater extent perhaps than any other country in Western Europe, the railways, by reason of, or as the outcome of State management, are called upon to carry an unusually large number of passengers either free or at greatly reduced fares. Members of the Italian Parliament and their families are liberally favoured with free travel, while journalists enjoy privileges unthought-of in Great Britain or in America. In addition to free passes there is also in vogue a system of allowing a 75 per cent. discount to many classes of the community, such as military men, naval men and employees in the civil service, to say nothing of the railway employees and their families. So much free and exceedingly cheap travel largely contributes to the poor financial results the working of passenger trains attain, no matter what direct benefit the favoured individuals enjoy, or what indirect advantage- more or less questionable— may accrue to the State by the perpetuation of the practice.

In Italy there is a great diversity of opinion as to whether the country is really the better served under State management than it would have been had the railways remained under private control. While it is argued that had the private companies been granted a free hand they would have been in as good or even in a better position than the State railways to-day, it is freely admitted that the privately-promoted and controlled railways handicapped as they were, and would have continued to be, by Government restrictions, could not be expected to indulge in enormous, although much-needed, expenditure on new construction works to lay-out and open new lines, and provide the requisite rolling stock, while each had hanging at all times over its head, like the sword of Damocles, the prospect of State purchase.

To sum up, average Italian opinion to-day appears to be that the railway system at present in operation, while open to improvement in more ways than one—and could not the same be said of almost every country's railways ?—meets to a large extent Italy's special needs, and, in spite of the large deficits shown in the annual returns, contributes in no small degree to the national prosperity.

Narrow Escapes on the Railway.

CONTINUING the reminiscences which appeared in the February RAILWAY MAGAZINE, Mr. Harris, late of the Metropolitan Railway Police Department, tells of some interesting, and in one or two cases startling, incidents that occurred during his long service. As a matter of fact, he says, it is a

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wonder that his connection with the Metropolitan Railway lasted 50 days instead of years, for in less than that period he had the first of several narrow escapes of being killed. During his first few days on the staff he had noticed how deftly porters and others crossed the line from one platform to another, and he made up his mind to try and do the same. When he did so he jumped down behind one train but omitted to see another coming in the opposite direction, and when he stepped on to the platform the engine of this train dashed past, actually brushing the back of his coat as it did so. He felt scared but has a very vivid recollection of the language uttered by the driver and admits that, if the latter had dared get off his engine, it is more than probable that he would have *settled* the job the engine had just failed to accomplish.

He calls to mind many narrow escapes of passengers, one of which happened at King's Cross station a long time ago. It was a Sunday afternoon, and in some unaccountable manner a woman got on to the permanent way and was in a very frightened condition. The Inspector (an elderly man) could hear a train from Farringdon Street coming round the bend to the station, so he jumped on to the line, caught hold of the woman and managed to pull her into the six-foot just as the engine went past them. Fortunately no up train happened to run in, else the consequences to both might have been very serious. As it was, neither were injured, and the incident would probably have passed unnoticed, after the momentary excitement, but for the fact that a reporter of an influential daily paper happened to be an eye-witness, and the next day a glowing account appeared with the result that subscriptions in appreciation of the Inspector's conduct flowed in, and eventually he was presented with £100. Such handsome pecuniary results, however, do not always follow brave actions, as the next incident which occurred a year or two later shows.

Not wisely but too well!

A MAN who had taken a little too much strong drink, but was not quite bad enough to prevent travelling, did what a good many others do when once they have passed the ticket examiner; *i.e.*, began to roll about, with the result that he fell off the platform right across the line. A train was heard coming in and he would undoubtedly have been run over and killed had not two porters, one from each platform, jumped on to the line and with some difficulty pulled him under the platform, and there the three lay while the train ran in. When the train had gone out, the two porters assisted the man on to the platform, none of them being actually hurt. One would have thought the man would have expressed *gratitude*, but he did not. On the contrary he pooh-poohed the idea of danger and said he would have been all right if they had left him alone. Unfortunately for the rescuers (from a financial point of view) there was no reporter on the spot, but their brave conduct was brought before the proper authorities and both were commanded to attend one of the Royal Palaces to receive a decoration.

Talking of narrow escapes, Mr. Harris relates the case of two men who fell over a balustrade to the foot of the stairs. Different stations were concerned, but the fall in each case was about the same. Yet, in the one instance, a drunken man was not hurt to any extent; in the other a sober man was killed instantaneously.

Compensation for Accidents.

As evidencing the seriousness of the liabilities of the companies in this matter, Mr. Harris mentions a case where a slight collision caused injury or a shaking to forty people. To *one* of these over £1,000 had to be paid, whilst the amount involved in settling the *whole* of the remaining *thirty*-nine did not reach that total. This indicates that, whereas if a person is in good health he can stand an injury or shock, it is entirely different if at the time of accident, he is not. A rather amusing instance of an extravagant claim is referred to. There had been a very slight contact between two trains, so slight that the majority of passengers did not know of it. Next day a letter was received from a passenger claiming £100, saying the accident had caused him palpitation of the heart. On being interviewed he turned out to be a youth, and it transpired that he had gone straight off to a doctor immediately after the mishap. He was told that, in those circumstances, anyone might be suffering from palpitation, and he was advised to keep quiet for a few days and instead of thinking about £100 compensation, reduce it to as many shillings, and then it might be considered. As a matter of fact he eventually accepted fifty shillings in settlement and appeared grateful for even that. It can only be assumed that some of his older associates had been "pulling his leg," advising him to claim something big while about it.

Indian Railways.

FROM the "Railways in India" administration report for the year 1920-21, recently received, we gather that the total length of Indian railways open for traffic on March 31, 1920, was 36,735 miles. During the financial year 1920-21, 298 miles were added, bringing

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the total mileage open on March 31, 1921, up to 37,029 miles. This great property is the result of 68 years of construction from the first modest opening in 1853, represented by the little suburban line from Bombay to Thana, 21 miles, laid with light iron rails and equipped with three small engines and a dozen primitive carriages.

The greater part of the railways in India consist of single track, but during the year reviewed by the report, 66 miles of line, from Begmanji to Chahi (63 miles) and Shakurpur to Delhi-Kishengunj (3 miles) on the North Western Railway were doubled. The following table shows the relative length of each kind of track at the end of last year.

	Miles.
Single	33,985
Double	2,948
Triple	29
Quadruple	64
Quintuple	2
Sextuple	1
Total	37,029

Triple to sextuple tracks are confined to areas in the vicinity of Calcutta and Bombay where the suburban traffic is very heavy.

The earliest railways in India were constructed on the 5 ft. 6 in. gauge which it was intended should remain the standard gauge. Later, principally on the score of economy, it was decided to construct lines on the metre gauge in places where the prospective traffic was not heavy or high speed essential. Many of the lines so constructed have been since converted to the standard gauge, but one of the earliest, the Rajputana-Malwa Railway, now part of the Bombay, Baroda and Central India Railway, still maintains its metre gauge track. Later still, various short feeder lines on the 2 ft. 6 in. gauge which originally were little more than steam tramways laid on existing roads, were added. Lastly a still smaller gauge of 2 ft. was first adopted for the purpose of the hill railway to Darjeeling which was opened in 1880, and further extensions of this gauge have since been made. There are thus at the present day four railway gauges in India, the mileages being :—

	Miles.
Broad (5 ft. 6 in.)	18,195
Metre (3 ft. 3⅜ in.)	15,248
Narrow (2 ft. 6 in.)	2,948
„ (2 ft.)	638
Total	37,029

At first railways in India were financed and constructed by companies supported by a guarantee of the Government of India. Direct State construction from borrowed capital began in the early seventies, and for some years this policy was steadily pursued. Later, the difficulty of finding the necessary capital by direct borrowing induced a return to the previous procedure, the State retaining the power to purchase after a definite period of tenure. The power to purchase has been consistently used to acquire railways as the Companies' contracts expired, and at present there are only four important lines, the Bengal and North Western the Southern Punjab, the Delhi–Umballa–Kalka, and the Rohilkund and Kumaon Railways which are not the property of the Government.

Apart from the above a considerable mileage of railways has in more recent years been constructed by Indian States and by the agency of small feeder companies. There are thus in India three principal owners of railways whose lines represent the following mileage :—

	Miles.
Government (including Provincial Governments and District Boards) ..	26,889
Indian States	4,394
Private Companies	5,746
Total	37,029

It will be seen that nearly six-sevenths of the total mileage belongs to Government and the Indian States, while only one-seventh is owned by private companies. Nationalisation, so far as ownership is concerned, of Indian Railways, has, therefore, already been practically effected.

The principle of Government-owned railways being leased to companies to work has in recent years been the subject of keen controversy. The question of future policy in this matter formed an important part of the deliberations of a special committee of experts assembled for the purpose during the year under review. The actual mileage worked by the different agencies is :—

	Miles worked.
Government	8,929
Indian States	2,889
Companies	25,211
Total	37,029

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MR. S. WILLIAMSON, Secretary and General Manager of the Cambrian Railways Company is retiring, as from April 30, 1922, from the dual positions he has held for 11 years. Mr. Williamson entered the service in 1882, and became Secretary in 1906. He became General Manager, in addition, in 1911. Mr. Williamson is a Lieut.-Colonel in the Engineer and Railway Staff Corps, and among numerous other activities a member of the Board of Management of the Railway Benevolent Institution.

* * *

MR. JOHN HERBERT VICKERY, General Manager of the Alexandra (Newport and South Wales) Docks and Railway, has been appointed Chief Docks Manager, Great Western Railway, with headquarters at Bute Docks, Cardiff. Mr. Vickery gained his experience in the course of a varied career with the London and South Western Railway. Beginning as a junior clerk in the Goods Manager's Department, and serving therein for eight years in various capacities, he was appointed Secretary to the Superintendent of the Line, and subsequently became head of various departments, ultimately becoming, before the age of 30, Chief Clerk in succession to Mr. (now Sir) Sam Fay. Five years later the late Sir Charles Scotter appointed him to the responsible post of London Divisional Superintendent, and a few years later he was promoted to be Assistant Superintendent of the Line. He was subsequently invited by Sir Charles Owens, then General Manager, to become his Assistant, and served in that capacity for several years. Mr. Vickery, who has had extensive experience in staff organisation, was the advocate of the company in connection with arbitration procedure, and a member of all the various Conciliation Boards connected with the railway. For many years he acted as Hon. Secretary of the London & South Western Railway Servants' Orphanage. He was also Vice-President of the London and South Western Railway Servants' Temperance Union. Early in 1913 he was selected to succeed Mr. John Macaulay as General Manager of the Alexandra (Newport and South Wales) Docks and Railway. He is a Magistrate, a Harbour Commissioner, a Pilotage Commissioner, President of the Newport Development Association, ex-President of the Newport Chamber of Commerce, Member of the Monmouthshire Territorial Army Association, Chairman of the Bristol Channel Dockowners' Association, Vice-President of the Newport Ratepayers' Association, Chairman of the Port Labour Committee and of the Cargo Labour Conciliation Board. He also represents East Wales on the National Port Labour Council as a member of the Executive Committee and of the interior Committees connected therewith. During the war he was co-opted to the Newport Corporation.

MR. S. WILLIAMSON,

Secretary and General Manager, Cambrian Railways, 1911-22.

* * *

MR. W. WADDELL, General Manager, Barry Railway, as a consequence of the

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Elliott] [*& Fry.*

MR. J. H. VICKERY,
Chief Docks Manager,
Great Western Railway.

recent amalgamation with the Great Western Railway, has become Docks Assistant to the Chief Engineer of the latter company. Mr. Waddell was one of the late Sir John Wolfe Barry's staff on the construction of the first dock and railways at Barry. On the completion of this work he was engaged by Foster, Brown and Rees for about 12 months in the survey and preparing of plans for the Vale of Glamorgan Railway, which was afterwards worked as part of the Barry system. In 1891 he joined the engineer's staff of the Barry Railway, and in the year 1893 was appointed Assistant Engineer under the late Mr. James Bell, succeeding him as Engineer in 1903. He succeeded Mr. T. H. Rendell as General Manager of the Barry Railway in March, 1919. Mr. Waddell is a member of the Institution of Civil Engineers, of the South Wales Institute of Engineers, and other learned societies.

MR. W. WADDELL,
Docks Assistant to the Chief Engineer,
Great Western Railway.

Elliott] [*& Fry.*

MR. F. W. SHOWERS,
Surveyor and Estate and Rating Agent,
Great Western Railway.

MR. F. W. SHOWERS, Principal Assistant to the Great Western Railway, has been appointed Surveyor and Estate and Rating Agent to the company. Born at Taunton in 1872, he entered the Great Northern Railway service at the age of 16, and was in the Traffic Department for four years, two of which were spent in the office of the Manager of the Midland and Great Northern Joint Railway. In 1892 he was transferred to the Surveyor's Office, and after four years at King's Cross went to Manchester to represent the Surveyor in connection with the purchase of property for the Great Northern Deansgate Goods Depôt. In 1899 he returned to London, and the rating work was added to

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By courtesy [*G.W.R. Magazine.*

MR. H. SIMPSON,

Locomotive Running Superintendent and Outdoor Assistant to the Chief Mechanical Engineer, Great Western Railway.

his other duties. In 1903 Mr. Showers became Chief Assistant to the Surveyor, and a year later was the recipient of the "Rosebery" gold medal for an essay on "The Rating of Railways." Mr. Showers joined the Great Western Railway in August, 1907, as Assistant Rating Agent, and was appointed Rating Agent in March, 1913.

* * *

MR. HENRY SIMPSON, Running Assistant to the Chief Mechanical Engineer, who has been appointed Locomotive Running Superintendent and Outdoor Assistant to the Chief Mechanical Engineer, Great Western Railway, joined the service as an apprentice at Wolverhampton in 1881. Four years later he entered the drawing office at Swindon as a draughtsman, and three years afterwards went in a similar capacity to Wolverhampton. He became Assistant Locomotive Foreman at the latter place in 1889, and in 1891 District Foreman at Stourbridge, which post he held until January, 1897, when he was made Assistant Divisional Superintendent for Newport, Cardiff and Pontypool Road. In 1902 he was appointed Divisional Superintendent at Swindon, and in 1906 was given the superintendency of the Newport division. He returned to Swindon in the position of Running Assistant to the Chief Mechanical Engineer two years ago.

* * *

MR. CHARLES CRUMP, O.B.E., for the past five years the London Divisional Locomotive Superintendent, has been given the additional appointment of Assistant Locomotive Running Superintendent. He entered the service in 1884, at Wolverhampton, where he served an apprenticeship to engine fitting and turning, and was afterwards in the drawing office. In 1891 he left to take up an appointment in Spain, but two years later returned to the Wolverhampton works. In 1894 he was appointed Assistant Foreman of the Wolverhampton running shed, and subsequently went back to the drawing office as Chief Draughtsman. In January, 1903, he was given the additional post of Assistant Superintendent, and two years afterwards went to Swindon as Assistant Manager of the locomotive works. Early in 1913 he was given the position of Assistant to the London Divisional Locomotive Superintendent, and he succeeded to the superintendency in 1916.

* * *

MR. J. W. SHAW, formerly Goods Manager, Hull and Barnsley Railway, has been made District Goods Manager, North Eastern Railway, Leeds, in succession to Mr. A. Brown, who was recently appointed Assistant Goods Manager. Briefly, the career of Mr. Shaw, who is a son of Mr. B. Shaw, for many years goods manager of the Lancashire and Yorkshire Railway, is as follows: Educated at Blackburn, and afterwards at Manchester Grammar School, first employed on the Great Western Railway staff of the District Goods Manager at Manchester. Having served five years there, joined the Hull and Barnsley Railway in 1885, as

By courtesy [*G.W.R. Magazine.*

MR. C. CRUMP, O.B.E.,

Assistant Locomotive Running Assistant, Great Western Railway.

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principal assistant to the Goods Manager. Took an active part in the organisation of the working of the goods traffic. Appointed Goods Assistant to the General Manager 1901, and Goods Manager, 1905.

* * *

AT the annual general meeting of the Great Northern Railway Athletic Association, held at King's Cross Station on April 6, a presentation was made on behalf of the members to Mr. Henry Jude, who has been the Hon. Secretary of the Association for the past 10 years, and is now retiring from the position. Sir Frederick Fison, Bart., a director of the company, and the President of the Association since its inception in 1887, made the presentation, and was supported by the following officers:—Mr. A. J. Brickwell, surveyor; Mr. C. J. Brown, Chief Engineer; Mr. C. J. Selway, Superintendent of the Line; and Mr. T. Smith, District Superintendent. The presentation took the form of a handsome mahogany bureau and two armchairs.

* * *

MR. GLEGGE THOMAS, Secretary and Rating and Estate Agent of the Cheshire Lines Committee, retired on March 31 after 44 years in the railway service. The staff of the Secretary's department and a number of friends have presented Mr. Thomas with a silver tea and coffee service and a case of Dunhill pipes. Mr. Thomas is a Fellow of the Surveyors' Institution.

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MR. R. H. PITTS, O.B.E., has been appointed to act as Staff Officer for the London Underground Electric Railway. Mr. Pitts will hold this post in addition to his duties as Secretary to the Joint Standing Committee of the companies.

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FOLLOWING the recent death at Gateshead of Mr. Robert Nicholson, late Locomotive Inspector in the North Eastern Railway service, a number of newspapers have recalled the association of the deceased with the "railway racing" in 1888 and 1895. He acquired the reputation, as an engine-driver, of creating a record between Newcastle and Edinburgh, which never has been beaten. As many RAILWAY MAGAZINE readers are aware the figures always quoted were taken from a guard's journal, which in certain particulars was proved to have been inaccurately compiled. According to the company's records on August 31, the last day of the race of 1888, with engine No. 117, he ran from Newcastle to Edinburgh (124½ miles) in 126 minutes, and in 1895, he far eclipsed this performance, with engine No. 1620, which did the journey in 113 minutes, or over 66 miles per hour!

* * *

THE Chinese Government has just accepted the resignation of Mr. William Henderson, who has been Chief Accountant of the Peking-Mukden Railway for over 20 years. The Peking-Mukden is the oldest as well as the most important of the Chinese Government lines. Mr. Henderson for some time past has also been Manager of the Railway Clearing House of the Railway Through Traffic Administration of the Ministry of Communications. Mr. Henderson is a chartered accountant, and contemplates returning to the home country to practice.

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SIR FREDERICK GEORGE BANBURY, Bart, M.P., who has been elected Chairman of the Railway Companies' Association for the year, has been Chairman of the Great Northern Railway Company since 1917. A Londoner, born in 1850, his education at Winchester completed, he entered his father's firm as a stockbroker and became the principal before he was 30 years of age. He entered the House of Commons for the first time in 1892 and took his seat on the board of Great Northern Railway directors in 1903, the year after he had been created a baronet. He is a vigorous champion of railway interests both in and out of Parliament.

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SIR WILLIAM FORBES, General Manager, London, Brighton and South Coast Railway, accompanied by Lady Forbes, was present at the competition of the St. John Ambulance Association recently held in the mess-room of the locomotive department at Brighton. During the proceedings, Lady Forbes presented the wrist watches won by the Brighton Railway's team in the England and Wales Shield Competition in 1921.

* * *

It has been decided by the North Staffordshire Railway directors to abolish the position of Registrar on the retirement of Mr. C. A. Lord, which has just taken place. Mr. J. Hudson is to act as transfer clerk and Mr. L. J. Browning as personal assistant to the secretary.

* * *

ON April 3, Mr. John Shaw, Goods Agent, High Street Station, Glasgow, took up his new position of District Commercial Superintendent, Edinburgh, to which he has been appointed by the directors of the North British Railway. Mr. Shaw has taken the place of the late Mr. J. M. Stevenson.

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To succeed Lord Peel as Minister of Transport, the appointment of the Earl of Crawford is announced. Lord Crawford—the 27th Earl of his line—was President of the Board of Agriculture and Fisheries, 1916; Lord Privy Seal, 1916–18; Chancellor of the Duchy of Lancaster from 1919–21. He combines his new office with that of First Commissioner of Works, and receives no salary as Minister of Transport.

* * *

THE Annual Competition for the Cambrian Railways Ambulance Shield took place at the Queen's Hotel, Aberystwyth, on April 7. The number of teams competing this year constituted a record for the Cambrian Centre, and is the result of the constant encouragement given to the movement by the Directors and the General Manager of the Cambrian Railways. The result of the competition was :—

Team.	*Marks obtained.*
Oswestry Traffic (No. 1)	231½
,, ,, (No. 2)	230
Afon Wen (No. 1)	229
Barmouth Junction	211½
Llanidloes	203½
Oswestry Works (No. 1)	195
Welshpool (No. 2)	190½
Afon Wen (No. 2)	186
Oswestry Works (No. 2)	185
Machynlleth	179½
Dovey Junction	171½
Aberystwyth	169
Oswestry (Engineers)	166½
Welshpool (No. 1)	166½
Oswestry Works (Juniors)	164
Builth Wells	141

The judges were Dr. Meredith Young, Chester, and Dr. Donaldson Tullis, Hereford. The various teams were highly complimented by the judges. The following Medical Instructors accompanied. the teams :—Dr. Thomas, Welshpool; Dr. Rees, Caersws; Dr. Davies, Aberystwyth; Dr. Jagger, Aberystwyth; and Dr. Lloyd, Towyn. All arrangements for the competition were made by Mr. T. C. A. Hodson, the Centre Secretary. The men were entertained to lunch by the Company at the Queen's Hotel, Aberystwyth. Mr. J. Burgess explained that, owing to a business engagement, Mr. S. Williamson, much to his regret, was prevented from being present, but that he hoped to be able to present the Challenge Shield and the prizes to the teams. Colonel David Davies, M.P., has promised to give prizes to the first three teams.

* * *

WITH reference to the circular of January 5 last, issued by Mr. David Cooper, General Manager of the Glasgow and South Western Railway, intimating that a prize of two guineas was again offered for competition for the best essay contributed by a member of the Glasgow and South Western Railway Ambulance Brigade, on "Antiseptics: Their Uses and Abuses," that gentleman has received the decision of the arbiter (Dr. J. Stewart Geikie, Ayr), in which he awards the first place to essay numbered "3" which was submitted by John Crosbie, carriage lifter, Barassie workshops, to whom has been forwarded the sum of two guineas. Mr. Cooper adds: "The essays submitted by the following competitors, whose names are shown in order of merit, have been highly commended: Robert Blane, engine driver, Ayr; George Milligan, goods guard, Hurlford; James Wark, painter, Kilmarnock workshops; David M'Harg, engine driver, Hurlford; Edward Jeffrey, passenger guard, Girvan.

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THE second congress of the Institute of Transport will be held in London from May 17 to 20 inclusive. The third Institute dinner will take place on May 18, and the meetings are to be held at the Institution of Civil Engineers.

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A COMMITTEE has been organised in Belgium to preserve at Bruges the site of the wartime execution of Captain Fryatt, the gallant commander of the Great Eastern Railway steamship *Brussels*, and the erection of a suitable memorial of his martyrdom.

* * *

AS most RAILWAY MAGAZINE readers are aware, the T.O.T. Philharmonic Society, the President of which is the Rt. Hon. Lord Ashfield, of Southwell, is recruited from among the staffs of all grades employed in the services of the eight railway, omnibus and tramway companies associated in the London Electric Railway group. The Society held its seventh Grand Evening Concert in the Central Hall, Westminster, on Tuesday evening, April 4, when a very large and thoroughly appreciative audience assembled to enjoy a most excellently arranged programme. In addition to the star artistes, Miss Dorothy Green (soprano), Mr. Edward Dykes (bass), Mr. Norman Long (entertainer), and Mr. George Ison (accompanist), there were present the military band, choir and orchestra of the Society numbering 300. The conductors were Messrs. Ewart Beech, A. Goodfellow, C. F. Lambert and Lieut. J. Ord Hume, L.F. Choir accompanist, Mr. G. Murlis; at the grand organ, Mr. A. E. Musgrove; conductor A.E. Company choir and orchestra,

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Mr. J. Johnson; accompanist, Mr. P. Thwaites; platform manager, Mr. A. R. Wellington. Among the large company present were the Rt. Hon. Lord Knutsford, Messrs. H. A. Vernet, G. Watson, D. Duff, R. Kerr Thomas and Cater Scott (directors), Messrs. Frank Pick and H. E. Blain, C.B.E., M.Inst.T. (managing directors) and Mr. J. C. Mitchell, secretary and treasurer of the companies. Other officers present included Messrs. W. A. Agnew, J. E. Ashby, P. V. McMahon, J. B. Mackinnon, A. Rozier, G. C. Shave, C. J. Spencer, J. P. Thomas, S. J. Webb and H. Lansdown. Where merit ranks so high it is difficult to name a particular performer without seeming invidious, but at the same time it must be admitted Miss Dorothy Greene well deserved the tremendous ovation she received. Among the conductors too, all perfectly capable and satisfactory, Mr. C. F. Lambert appeared an outstanding figure. Neither will a word of appreciation be amiss in regard to the selections on the grand organ given by Mr. A. E. Musgrove for a quarter of an hour or more while the members of the audience were being seated. Altogether it was a very fine concert.

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THE 5th and final meeting of the 7th Session of Efficiency Meetings at the L.G.O.C. Training School, Milman's Street, Chelsea, has been held, Mr. H. E. Blain, C.B.E., Assistant Managing Director, presiding over an attendance of upwards of 300 members of the Administrative and Control Staffs of the Allied Companies. The papers on this occasion—"Problems of my Official Life"—were read by:—(*a*) E. J. Tyley, Traffic Controller, District Railway; (*b*) J. Adkins, Office of Superintendent of the Line, Railways; (*c*) G. P. Stuart-Clark, Divisional Inspector, L.G.O.C.; (*d*) R. Hodson, Garage Superintendent, Plumstead Garage, L.G.O.C.

* * *

AFTER an interval of eight years, the Great Western London District Goods Salaried Staff held, on March 25, what was formerly an annual dinner. Mr. J. W. Lovejoy, the head of the district, presided, and in proposing the toast of the Great Western Railway, coupled with it the name of Mr. E. Lowther, Chief Goods Manager, Great Western Railway. Mr. Lowther, in replying, said he was more than gratified that they had invited him. It was his first visit, and he hoped it would not be the last. The Great Western was a big company to respond for; it covered a very large share of the map. They were all pleased it was to retain the name of Great Western. At midnight a number of Welsh railways fell into the lap of the Great Western. Already it had 92,000 employees, and another 14,000 were about to be added to that number, whilst another lot would soon follow, and another lot after that. Many traders thought that with grouping they would have no competition, but it seemed that competition was to be keener than ever. Already the traders were finding three or four men on their steps. The Great Western might not have so many representatives as other companies, but what men they had, at any rate, were good. Speaking of road motor competition, he thought it would be most unfair if the railway companies were denied the service of the road. They were very large ratepayers, and in some cases paid most of the rates. At the present time the road hauliers only took the best of the traffic and left the worst. With regard to rates, it must be remembered that the railways had been handed back by the Government with their earnings reduced and their expenses greatly increased. Naturally, the railway companies wished to see the industries of the country in a satisfactory state.

* * *

AT the Mechanics' Institute, Stratford, E., the final in the Great Eastern Railway Ambulance competitions took place on April 4, and resulted as follows:—(1) Parkeston, 393 points; (2) King's Lynn, 349⅛; (3) Stratford A, 334; (4) Colchester, 323; (5) Liverpool Street, 282⅛; (6) Stratford B, 280⅛; (7) March, 264¼. V. Egglington (King's Lynn), scored 91 out of a possible 110 points in the individual and final tests, and was awarded an efficiency prize. Subsequently, at the Stratford Town Hall, Lady Ailwyn, wife of the Vice-Chairman of the Great Eastern Railway, presented the prizes. Lord Ailwyn who presided, congratulated the winning team and expressed the gratification of the directors at the interest taken by the staff in ambulance work. He announced the winning team would represent the Great Eastern Railway in the competitions for the Inter-Railway Challenge Shield.

* * *

MANY RAILWAY MAGAZINE readers will rejoice in the announcement that the Great Western Railway have decided to repaint their carriages chocolate brown with cream upper panels, the colours for which they were famous up to a dozen years ago. Since then they have painted them dark red brown. The first train to be repainted will be the Cornish Riviera express, which daily runs between Paddington and Plymouth (225·7 miles), the longest non-stop journey in Great Britain.

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On this page is illustrated the War Memorial at St. Enoch Station, Glasgow, recently unveiled by Field-Marshal Earl Haig, who was introduced to the assembly by Lord Glenarthur, Chairman of the Glasgow and South Western Railway. Among the floral tributes laid at the foot of the memorial were wreaths from Lord Glenarthur on behalf of the directors, Lady Haig, Mr. David Cooper, General Manager, and over 80 wreaths from the Glasgow and South Western Railway staff in the various departments all over the system. In introducing the gallant Field-Marshal, Lord Glenarthur remarked: We are met here to-day to do honour to the men of the Glasgow and South Western Railway who gave their lives for their country in the Great War. Out of our staff of 9,800, more than 2,400 men left the service of this railway to join His Majesty's Forces, and many more would have gone if they could have been spared from the railway duties which were so essential to the nation in war time. We are proud of the response so bravely made to the call of our King and Country, but we have to mourn the loss of 302 men who made the supreme sacrifice. We all felt that it was incumbent on us to set up a memorial to these men, as enduring evidence of our admiration and gratitude; a constant reminder of the great cause for which they fought, and of duty nobly and faithfully done. It is a high privilege to have with us to unveil the Memorial, Field-Marshal the Earl Haig, the great Commander who led our Armies to victory, and who is ever mindful of the welfare and interests of soldiers no less in peace than in war, and especially of those who have suffered misfortune. We thank him most heartily for coming here to-day to render this tribute to the memory of our fallen comrades.

Photo.] GLASGOW & SOUTH WESTERN RAILWAY WAR MEMORIAL AT ST. ENOCH STATION, GLASGOW. [*Lafayette.*

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ACCEDING to a request made on behalf of London newspaper workers, post office employees, and others whose employment detains them in town until a late hour, the Midland Railway have decided to put back the last train to Southend by five minutes. On and from May 1 it will leave Fenchurch Street at 12.20 a.m. instead of 12.15 a.m. as formerly.

* * *

FOLLOWING upon a recent visit of Great Western Railway officers to Swansea, it was locally announced that the High Street (Swansea) Station is to be practically reconstructed, the outlay involved approaching £250,000. The work is to be started almost immediately. The station front is to be set back 30 ft., a large entrance hall with refreshment rooms is to be built, and the platforms lengthened to 800 ft.

* * *

ON and from April 3 the Midland Railway instituted an arrangement for reserving seats at starting point of all their express trains, and also at the starting point of all through carriages attached thereto, at a charge of 1s. per seat. The London and North Western Railway also on and from the same date began to reserve seats in all their Euston trains serving places in Scotland at 1s. per seat.

* * *

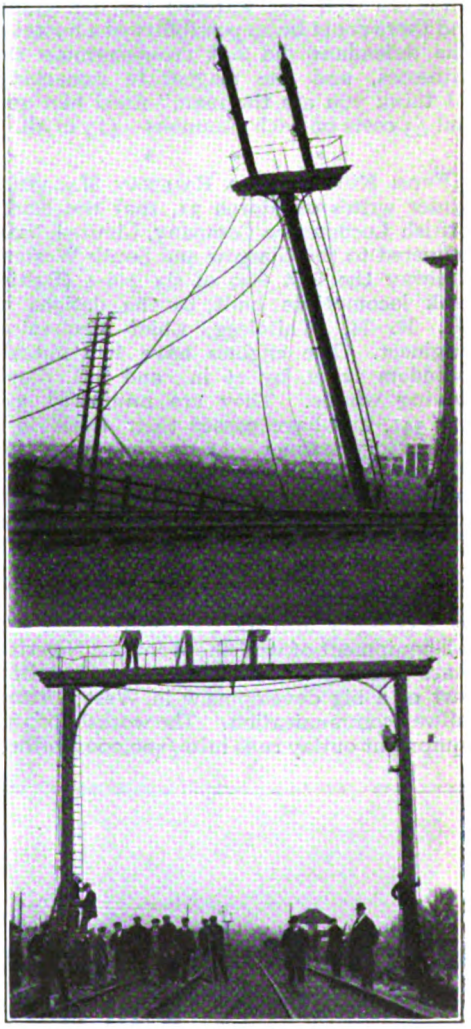
ON April 5 the Metropolitan District Railway commenced the practice of issuing cheap day tickets from Uxbridge on Wednesdays, by a special train at 1.30 p.m. Third-class return fares by this train are as follows :— Ealing Common, 1s. 3d.; Hammersmith, 1s. 6d.; Hight Street, Kensington or Earl's Court, 1s. 9d.; Victoria or Charing Cross, 2s. These special tickets are available for the return journey by any train after 6 p.m. on the day of issue.

* * *

BASSETT-LOWKE is a name that is known wherever model locomotives or steamships are appreciated, and in such circles RAILWAY MAGAZINE readers are conspicuous. It will therefore interest a large number to learn that the firm of Messrs. Bassett-Lowke, Limited, have opened a new retail branch and show rooms at 1, Frederick Street, Edinburgh. These premises, which were recently occupied by the firm's esteemed agent, Mr. E. T. Young, and known as "The Model Workshop," are situated at the bottom of Frederick Street, just off Princes Street. Mr. Young, we understand, has, owing to ill-health, been compelled to give up business for a time. The existing well-assorted stock of scale models has been augmented by a full range of the well-known Bassett-Lowke models, so that old and new customers who visit the premises may have their wants promptly supplied.

* * *

ON the Midland main line the distant signal at Bedford South, consisting of a signal post with two arms, has recently been replaced by a gantry carrying signals for the up and down lines. Two photographs are reproduced on this page; one shows the old signal post in the act of falling, and the other after its place has been taken by the gantry.



REMOVING THE OLD SIGNAL POST AND INAUGURATING THE NEW SIGNAL GANTRY AT BEDFORD SOUTH, MIDLAND RAILWAY.

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AT the North London Police Court a man resident in Shepherd's Bush was summoned for travelling on five occasions on the tube railways without having paid his fare, and for giving a false name and address. The defendant declared he was not the person whom the railway officials alleged had travelled wrongfully on the tube. For the railway company it was said that there were witnesses who had watched the defendant, and there could be no possibility of a mistake. The defendant did not cross-examine the witnesses, and the magistrate remarking, "I think you are the man," fined him 40s. and £3 costs on each summons—£25 in all.

* * *

FROM Kilmarnock a RAILWAY MAGAZINE reader writes on March 31, that the North British Locomotive Company, Limited, have delivered to the Glasgow and South Western Railway the first two of six 4-6-4 (Baltic) tank locomotives built to the designs of Mr. R. H. Whitelegg, Chief Mechanical Engineer. The engines have two outside cylinders 22 in. by 26 in., and 6 ft. diam. driving wheels. They are numbered 540 and 541, and have passed their trials in a satisfactory manner. At the time of writing the engines were in service between Glasgow and Kilmarnock, and between Glasgow and Ayr, including the fifty-minute expresses on the latter route.

* * *

AN important contract has been secured by a Glasgow firm for the construction and full equipment of workshops for the Nigerian State Railways. The contract is the initial part of a big development in West African railway communication. The workshops and equipment outlay runs into £500,000 sterling.

RECENTLY there has been delivered to the Caledonian Railway two more palatial and luxuriously appointed Pullman cars to add to their stock, which in the past season formed so attractive a feature of the line. The new dining cars are a degree finer than anything hitherto produced for any railway. In accordance with the Caledonian Railway's custom they have been named respectively *Bonnie Jean* and *Lady Nairne*, and their advent will further enhance the galaxy of bygone Scottish female celebrities commemorated by the other dining and buffet Pullman cars which bear the names of *Flora MacDonald, Lass o' Gowrie, Fair Maid of Perth, Duchess of Gordon, Mary Hamilton, Mary Beaton, Mary Carmichael, Mary Seaton, Helen MacGregor, Annie Laurie, Maid of Morven*. The latter which is an observation car, runs exclusively on the Callander and Oban Railway—in connection with convenient trains from and to Glasgow and Edinburgh—and affords a magnificent view of the scenic grandeur for which that section of the Caledonian Railway is justly famed. The finest observation car in Europe has hitherto been considered to be the American car which runs on the Eastern Tyrol, but the *Maid of Morven* is superior to it, and is one of the finest cars in the world.

* * *

STATEMENTS have been published indicating that a notable 4-6-2 locomotive is under construction at the Darlington Works of the North Eastern Railway. No further particulars are yet available, except that the boiler will be of the largest practicable dimensions and the weight of the engine alone will be about 100 tons.

JUNE, 1922,
RAILWAY MAGAZINE
WILL BE THE
300th NUMBER.

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THE RAILWAY MAGAZINE.

GREAT NORTHE[R] LOCOMOTIVE No. 1470.

ineer.

Fitted with Wakefield's Mechanica[l] Wakefield's Forced Feed System of Lubrication to

Cylinders (3), 20 in. Trailing Wheels, 3 ft. 8 in. diameter.
Boiler equipped with Robinson Diameter, 6 ft. 5 in. Grate Area, 41¼ sq. ft.
Steam Pressure, 180 lbs. per sq. i tons 6 cwt.; Engine and Tender, 148 tons 15 cwt.

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Photo.] TANK ENGINE EXPRESS WORKING "IN EXCELSIS." [*O. J. Morris.*

One of the latest London, Brighton and South Coast Railway 4–6–4 tank engines, No. 329 "Stephenson," on Down "Southern Belle" Express.

The Railway Magazine, July, 1897, to June, 1922.

TWENTY-FIVE years ago the first number of the RAILWAY MAGAZINE was issued, establishing a new feature in periodical journalism, a monthly publication dealing with a single subject, albeit a wide and comprehensive one, yet designed for general sale in addition to that to be expected from the shareholders, officers, employees and others associated with the great and important industry to which it applied. There were, it is true, a number of weekly and monthly publications concerned with railway finance, politics, engineering and staff matters. But the RAILWAY MAGAZINE constituted a striking departure in that it was, from the first, intended to cover the whole field of railway enterprise, operation and activity in an informative and instructive manner, in view of the keen and intelligent interest in railway history, material, motive power, machinery and methods taken by so large a section of the travelling public, as well as by railway directors, officers and staff of all grades.

It was, indeed, a novel venture, but the standing and favour at once achieved by the RAILWAY MAGAZINE abundantly prove the correctness of the view that subjects of public interest justify popular as well as private and technical or trade publications.

No. 1 introduced one of the Magazine's most successful features, initiating with an "Illustrated Interview" with the late Sir (then Mr.) J. L. Wilkinson, in 1897 General Manager of the Great Western Railway, a long series of corresponding articles setting forth in a collective manner the main historical facts, and presenting the chief matters of interest in regard to all the leading and many of the smaller railways. Later there were included "Illustrated Interviews" with Chief Mechanical Engineers and other departmental officers, in addition to those with General Managers and occasionally Chairmen of railway companies. In more recent years these have given place to issues dealing even more comprehensively with particular railways, such as the London and North Western "Diamond Jubilee" Number (August, 1906), the Caledonian Railway "Diamond Jubilee" Number (September, 1907), and

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the London and South Western (June, 1911), Great Northern (September, 1910), Lancashire and Yorkshire (February 1911), and other special numbers ; and to articles describing departmental work and personnel, the great railway works, or reviewing various railway subjects in a similarly complete and authoritative manner.

Other special features have been the numerous historical and descriptive articles, the profusely illustrated series dealing with "Notable Railway Stations," commencing with the issue for November, 1899, and the colour plates of engines and trains presented with a large proportion of the issues since that for July, 1899. Contributions by practical railwaymen, discussing subjects affecting railway work in various phases, have also frequently been included.

What has proved, however, one of the most popular series is that begun by the late Mr. Charles Rous-Marten in September, 1901, under the title of "British Locomotive Practice and Performance," Conducted by him until his sudden death in April, 1908, it was continued until May, 1909, by Mr. R. E. Charlewood. For some time it was taken in turn by the Rev. W. J. Scott, B.A., Mr. Cecil J. Allen, and Mr. J. F. Gairns, all three of whom, it may be noted, contribute to the present number. From January, 1911, however, Mr. Allen alone has been responsible for "British Locomotive Practice and Performance" and after celebrating his 100th article in October, 1918, he has now reached a total of 144 contributions under this heading, with at least as great appreciation as that given to those of the talented originator of the series.

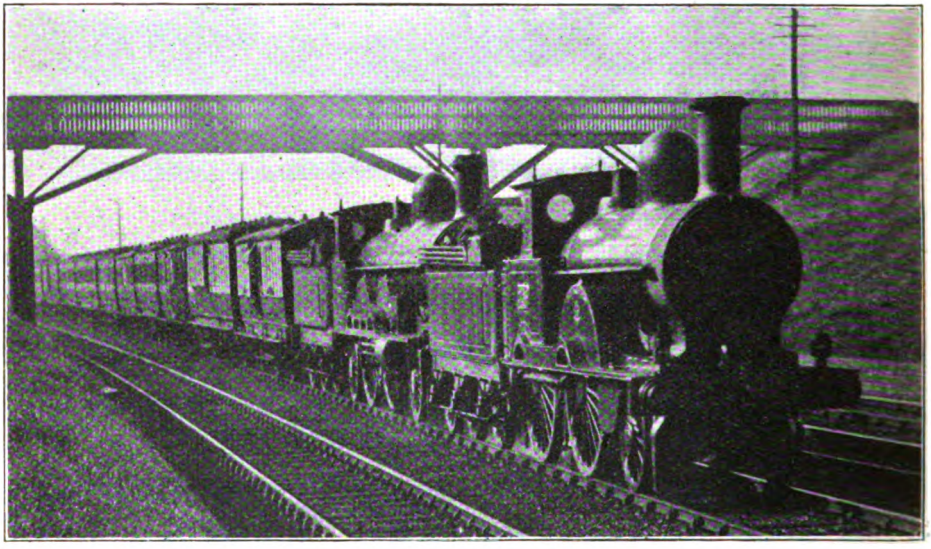

Photo.] [*F. E. Mackay.*

LONDON AND NORTH WESTERN RAILWAY MOTIVE POWER IN 1897.

One of Mr. Mackay's earliest photographs showing a train worked by Webb three-cylinder uncoupled 2-2, 2-2 locomotive "Henry Bessemer" ("Greater Britain" class), in 1897 on principal main line duties, piloted by one of the ever-useful 2-4-0 engines of the "Precedent" class, "Alma," which at that time shared most of the express working with the various "compounds," and many of which are still at work.

Other notable series which may be specially mentioned are the "Reminiscences" contributed by the late Mr. Robert Weatherburn (from October, 1912, to March 1915), and Mr. E. L. Ahrons' articles under the general heading of "Locomotive and Train Working in the Latter Part of the Nineteenth Century," the first of which appeared in January, 1915. Another standard feature is the annual review of "Summer Train Services," commenced in September, 1898.

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Throughout the twenty-five years which have elapsed since July, 1897, the systematic policy of the RAILWAY MAGAZINE has been that of providing authoritative information and instructive articles, technically correct, yet written and illustrated to suit readers who are not necessarily technically expert, though ever keeping high above the level of what may be termed "irresponsible popular journalism." Indeed, the greater proportion of the contributions have been by writers whose qualifications, technical and practical, are beyond question, and frequently by railway officers at the time occupying, or who have since attained, leading positions in the railway world. One of the most gratifying facts is the recognition of the RAILWAY MAGAZINE as satisfactory alike to practical railwaymen and to non-railway readers. In comment and occasionally criticism, too, the RAILWAY MAGAZINE has systematically claimed freedom of expression, while at the same time accepting full responsibility for accurate knowledge and absence of bias before dealing with any controversial topic.

But though there are direct links between No. 1 and No. 300, there have been numerous vital changes, and while "Pertinent Paragraphs" and "What the Railways are Doing," now regarded as essential and characteristic features, were both begun in No. 1, yet the years which have passed have witnessed many improvements and special developments. Even during the war period, when the RAILWAY MAGAZINE was, in common with other publications, conducted under many difficulties, and, in view of the importance of railways in regard to national problems of the time, was necessarily debarred from dealing with many subjects, it maintained a large circulation without retrograding more than was inevitable from the high standard it had reached in 1914.

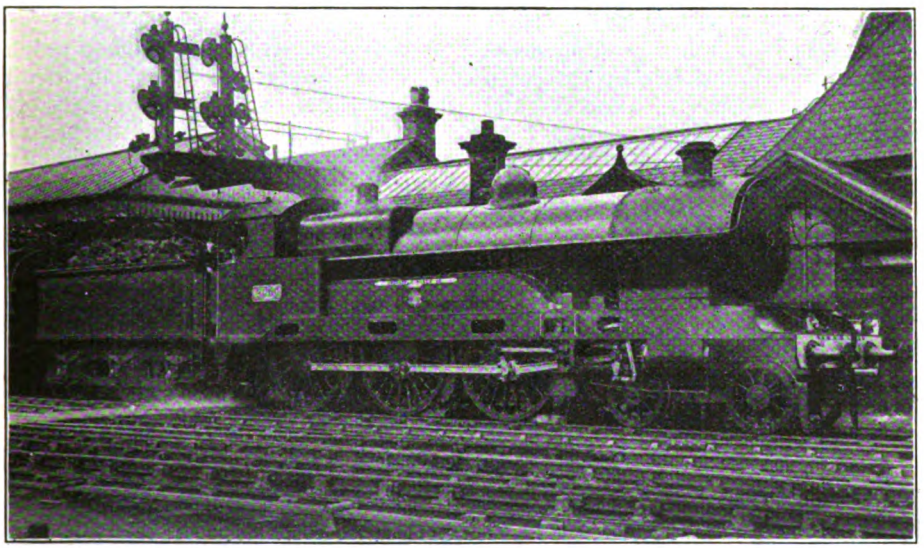

Photo.] [*P. F. Cooke.*

LONDON AND NORTH WESTERN RAILWAY MOTIVE POWER IN 1922.

One of the latest four-cylinder 4-6-0 locomotives of the "Claughton" class, No. 2035, "Private E. Sykes, V.C." This is one of three engines named after L. & N.W.R. employees to whom the Victoria Cross was awarded for special gallantry and courage during the Great War. This photograph is further interesting in that ex-Private E. Sykes, V.C., is on the footplate, and the engine is standing in Stalybridge Station, where he is employed as a ticket-collector.

It is, therefore, with a certain degree of pride that we present this 300th number, and it is with special pleasure that we have to acknowledge so many expressions of appreciation and congratulation, as mentioned in "Pertinent Paragraphs" last month, received in anticipation of the June, 1922, issue. What has been accomplished has, however, only been rendered

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possible by the valuable and continuous co-operation and assistance so generously accorded by railway officers of all ranks, from the time when the preparation of No. 1 was in progress until now, and by the services of both regular and occasional contributors throughout the same long period, many, alas! no longer with us, and including some who gave their lives during the great war. Without such an excellent combination of forces it would not have been possible for the RAILWAY MAGAZINE to have progressed in the way it has done, and perhaps the most important aspect of all is that it has been achieved contemporaneously and side by side with the continuous records of progress and development which have characterised British railways throughout the period concerned, as demonstrated by the series of specially written articles included in this 300th number.

And now that the home railways are in process of general amalgamation and reorganisation the question may be asked: how will the new railway situation affect the RAILWAY MAGAZINE? It is notoriously unsafe to prophesy, but so far the proprietors see no reason for other than optimistic views, for while many changes must occur in due course, dictated as much by the demand for progress as by force of circumstances, the preparation of No. 301 and its successors is being undertaken with the confident expectation that the new railway era will provide not merely as many but certainly even more railway problems of vital importance for consideration in our pages, while the records of the past will never lose their interest so long as readers such as those which we have had for the last quarter of a century continue to subscribe to the RAILWAY MAGAZINE.

AN INTERESTING LOCOMOTIVE COMBINATION ON THE SOUTH EASTERN AND CHATHAM RAILWAY.

Photo.] [*E. A. Gurney-Smith*

"PARIS, LIMITED," PULLMAN CAR CONTINENTAL EXPRESS, VICTORIA TO FOLKESTONE, PASSING BECKENHAM JUNCTION.

Pilot engine: Wainwright 4-4-0, No. 738, as originally built.
Train engine: ,, ,, No. 749, as rebuilt and superheated.

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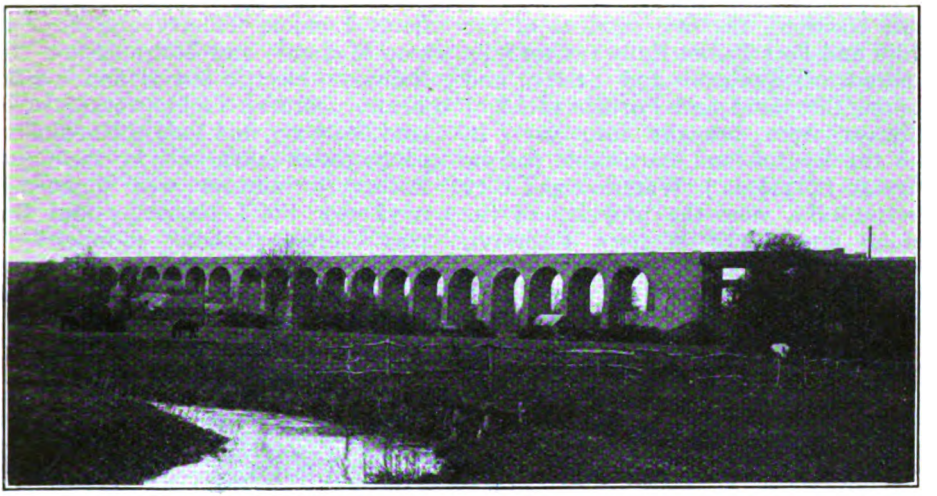

BRACKLEY VIADUCT GREAT CENTRAL RAILWAY.
One of many heavy engineering works entailed in the construction of the Great Central Railway extension to London, formally opened March 15, 1899.

Twenty-five Years of Railway Progress and Development.

By J. F. GAIRNS, M.Inst.L.E.

RAILWAY mileage in 1897 was officially given as 21,433 miles for the British Isles, of which 11,732 miles were double track or more. In the course of the past 25 years the total length of railway (officially stated as 23,734 miles according to the latest returns available) has increased by 2,300 miles, and double track or more is provided on no less than 13,429 miles. Detail figures as to the mileage laid with more than two lines in 1897 cannot be given; but there are now about 2,000 miles with from three to 12 or more lines abreast. Therefore, while the total route mileage increase is not so great—indeed, it could not be, seeing that all the trunk lines and main routes except the Great Central London extension were completed long before 1897, and additions are therefore short or of medium length—there has been a very large proportionate increase in multiple track mileage. As the extent to which multiple track is provided is an important indication of traffic increase, this aspect calls for due emphasis.

During this period, again recalling that all the great main routes, with the exception noted, had been already constructed, and that these account for so large a proportion of the capital subscribed to railway companies, the total paid-up capital of British railways, including in each case nominal additions, has increased from £1,242,241,166 to £1,327,486,097, that is, by some £85,000,000, apart from the cost of new works, &c., paid for out of revenue.

First in regard to newly constructed railways, added during and since 1897. These include several lines of great commercial importance, though mileage may be relatively small, such as the Cardiff and Port Talbot, with their associated dock activities, and the London "tube" railways, whose construction has revolutionised the transit problem of the metropolis. There are also many light railways by which various agricultural and hitherto remote districts have been given valuable transport facilities.

In 1897 the Glasgow District Subway

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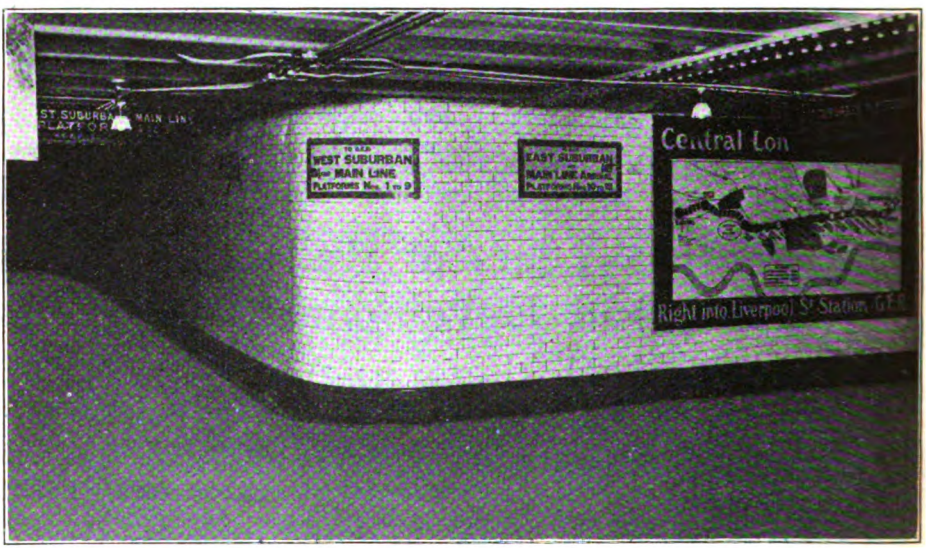
(cable traction), the first sections of the Cardiff and Port Talbot Railways, and the Hundred of Manhood and Selsey, and Weston, Cleveland and Portishead Light Railways were brought into use. In 1898 the Lynton and Barnstaple narrow gauge (1 ft. 11½ in.), Waterloo and City (electric tube, now the property of the London and South Western Railway), and North Sunderland light railways, were added. 1899 saw the completion and opening of the Great Central extension to London, the greatest achievement of the kind in Great Britain in modern times.



SUBWAY AT LIVERPOOL STREET STATION, CENTRAL LONDON RAILWAY.
Railway construction work now very familiar, but almost, if not quite, unknown in 1897.

In 1900 the Rother Valley Light Railway was opened from Robertsbridge to Tenterden, and the Sheffield District Railway (worked by the Great Central Railway) and the Central London electric railway (Bank to Shepherd's Bush) were inaugurated. And in 1901 the Bideford, Westward Ho! and Appledore (closed during the war and not yet reopened), Sheppey Light (worked by South Eastern and Chatham Railway), and Basingstoke and Alton (a "light" line worked by the London and South Western Railway, closed during the war and not yet reopened), were completed.

In 1902 the Crowhurst and Bexhill (worked by the South Eastern and Chatham Railway), Whitechapel and Bow (joint London, Tilbury and Southend—now Midland—and Metropolitan District Railways, electric but at first worked by steam), Dornoch Light (worked by Highland Railway), and Vale of Rheidol narrow gauge (later taken over by the Cambrian Railways) railways were opened. The next year the Letterkenny and Burtonport Railway (Ireland), 49 miles in length 3 ft. gauge, Llanfair and Welshpool, Light (worked by Cambrian Railways), Lanarkshire and Ayrshire extension (worked by Caledonian Railway), Meon Valley and Axminster and Lyme Regis (worked by London and South Western Railway), Axholme Joint (North Eastern and Lancashire and Yorkshire—now London and North Western—Railways), and Wick and Lybster Light (worked by Highland Railway) railways were opened. In 1904 the Tanat Valley Light Railway (worked by the Cambrian Railways), Great Northern and City Electric (now Metropolitan Railway), Leek and Manifold narrow gauge (worked by North Staffordshire Railway but having its own rolling-stock), Kelvedon, Tiptree and Tollesbury Light (worked by Great Eastern Railway), Mid-Suffolk Light and Burtonport Extension Railways were opened. 1905 saw the Cairn Valley Light (worked by Glasgow and South Western Railway),

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and Dearne Valley (worked by Lancashire and Yorkshire Railway, now London and North Western Railway) railways opened. 1906 includes quite a lengthy list: part of the Baker Street and Waterloo electric (now London Electric), Bankfoot Light (worked by Caledonian Railway), Amesbury and Bulford Light (worked by London and South Western Railway), Burton and Ashby Light (Midland Railway, worked by electric tramcars), Corringham Light, North Lindsey Light (worked by Great Central Railway), Campbeltown and Machrihanish (1 ft. 11½ in. gauge), and Great Northern, Piccadilly and Brompton (now London Electric) railways. In 1907 the Charing Cross, Euston and Hampstead Railway (now London Electric) was added.

In 1908 the Bere Alston and Callington section of the Plymouth, Devonport and South Western Junction Railway, worked with its own rolling-stock, was opened, and in 1909 the Strabane and Letterkenny (3 ft. gauge) Railway in Ireland. Also the Cleobury, Mortimer and Ditton Priors Light, Newburgh and North Fife (worked by North British Railway), and part of the Castleblaney, Keady and Armagh Railway (worked by Great Northern Railway, Ireland) in Ireland. In 1910 the South Yorkshire Joint Committee's Railway (Great Northern, Great Central, North Eastern, Lancashire and Yorkshire—now London and North Western—and Midland Railways) was opened. 1911 saw passenger traffic inaugurated on the Cardiff Railway, and the Shropshire and Montgomeryshire Light, East Kent, and Mawddwy (worked by Cambrian Railways) lines opened. In 1912 the Cork City Railway was opened, the Dearne Valley line brought into use for passenger traffic, and a section of the Derwent Valley Light Railway opened. In 1913 the Elsenham and Thaxted Light Railway (worked by Great Eastern Railway) was opened, and a part of the Mansfield Railway (worked by Great Central Railway) brought into use for mineral traffic.

Then came the war years, which effectively put a stop to much in the way of new railway construction, and the only items which need be mentioned here are: a part of the old Ravenglass and Eskdale, reopened in 1915 as the Eskdale Railway (15 in. gauge), and the Mansfield Railway, brought into use for passenger traffic (1917). The Ealing and Shepherd's Bush Electric Railway, worked by the Central London Railway, was opened in 1920.

A lengthy list, but including a number of lines which now count for a great deal, particularly in regard to the London electric tube railways, which are further dealt with in Colonel O'Brien's article elsewhere. It must be remembered, too, that except where worked by another company and as noted, most of these lines possess their own locomotives and rolling-stock.

It is, however, the extensions of previously existing railways which have had the greatest influence, and the outstanding items may now be set forth. In 1897 the Highland Railway extended its Skye line from Stromeferry to Kyle of Lochalsh, and in 1898 the North British Railway completed the East Fife Central lines. 1899 was the historic year for the Great Central Railway, in that its London extension was opened, giving the company a main trunk route and altering many of the traffic arrangements previously in force with other lines. Indeed, the creation of this "new competitor" for London, Leicester, Nottingham, Sheffield, Manchester and, later, Bradford traffic, materially changed the general railway situation in many respects. In the same year the Highland Railway direct line, from Aviemore to Inverness was opened, this also having a considerable influence upon Highland traffic. In 1900 the London, Brighton and South Coast Railway completed the new "Quarry" lines, giving an independent route from Coulsdon to Earlswood.

In 1901 the Great Western Railway opened the Stert and Westbury line, one of the first stages involved in the policy of providing new and shorter routes, which has so essentially changed the whole character of Great Western Railway train services and traffic operation. In that year, also, the West Highland Railway (now North British Railway) was extended to Mallaig, adding one of the most scenically attractive and constructionally notable lines in the British Isles. The Bickley-Orpington connecting lines of the South Eastern and Chatham Railway, brought into service in 1902, enabled trains of

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either section to use any of the London termini, and this has essentially changed the main features of many of the train services of the Managing Committee. In 1903 the Great Western Railway opened the new Badminton lines for Bristol and South Wales traffic, a second stage in the metamorphosis of this system. In 1906 the Fishguard-Rosslare route was completed for Anglo-Irish traffic, while the opening of the Great Central and Great Western joint line via High Wycombe materially altered London traffic for both companies in many respects. The same year saw the completion of connecting links whereby from that time the chief route for London-West of England traffic by the Great Western Railway has been via Westbury instead of via Bristol.

The year 1908 provided still another Great Western innovation, the completion of the Birmingham and West of England route via Stratford-on-Avon and Cheltenham. In 1909 the London and North Western Railway opened the Wilmslow-Levenshulme line, providing an express route for London-Manchester traffic avoiding Stockport. In that year also the Thornhill connection between the Midland and the then Lancashire and Yorkshire Railway introduced new through facilities. In 1910 the opening of the Enfield-Cuffley line of the Great Northern Railway provided the first link in a new route for main line traffic to and from London, though this is even yet only partially available, and opened up a new suburban area for development. The same year saw the advent of the Ashenden-Aynho line, by which the Great Western Railway obtained the shortest route from London to Birmingham, with consequent essential changes in the north train services, and the inauguration of the famous two-hour expresses by that route and also by the London and North Western Railway. In 1912 the latter railway brought into operation part of the Watford lines, paving the way for material changes in traffic methods, and in due course for through working of London Electric trains between the Elephant and Castle and Watford, and for electric traffic to and from Broad Street and very shortly from Euston also. In 1913 part of the Swansea district lines were brought into use by the Great Western Railway, and in 1915 the North British Railway opened the new Lothian lines.

THE METROPOLITAN RAILWAY ELECTRIFIED.
A view at Wembley Park showing electrically equipped track and widenings added since 1897.

It will thus be seen that during the 25 years under review there has been much scope for the railway constructional engineer, while many of the developments indicated necessarily in outline only,

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have caused essential changes of a far-reaching character. In conjunction with station reconstructions, widenings, docks, port improvements, new bridges, &c., there is so much that could be dilated upon that material is available for a long series of articles. Space will, however, permit only of brief review of a few of these items.

To the list of long railway tunnels over a mile in length the following have been added :—

	Miles.	Yards.
Sodbury, Great Western Railway, Badminton line.. ..	2	913
Ponsbourne, Great Northern Railway, Enfield - Stevenage line	1	924
Sapperton, Great Western Railway, Badminton line.. ..	1	100
Merstham (New), London, Brighton and South Coast Railway, " Quarry " line ..	1	353

In regard to notable bridges, the new King Edward Bridge at Newcastle and the Queen Alexandra Bridge at Sunderland (North Eastern Railway), may be mentioned. Of new or reconstructed and enlarged stations, Victoria (London, Brighton and South Coast Railway), Glasgow Central (Caledonian Railway), Victoria, Manchester (Lancashire and Yorkshire Railway, now London and North Western Railway), Waterloo (London and South Western Railway), and Snow Hill, Birmingham (Great Western Railway) are the outstanding examples. Enlargement of Paddington station, the new engine depôt at Old Oak Common, and improvement works all over the system are associated features of the Great Western Railway record since 1897. In the case of the London and North Western Railway, the new carriage lines outside Euston, enlargement of the terminus, the Chalk Farm system of over and under connections now virtually completed, with a new " tube " tunnel under Primrose Hill, the Watford " new " lines, with all they have involved and will entail, reconstruction of Crewe station and the wonderful system of avoiding lines there, and many other works might be set out at length were space available.

The outstanding event in regard to the Midland Railway is the taking over of the London, Tilbury and Southend Railway in 1912, and the completion of the widening and reconstruction works between Campbell Road Junction and Barking. London and South Western Railway history during the period under review involves not only the electrification of suburban lines, the reconstruction and enlargement of Waterloo station, and the construction of the new Feltham concentration yard, but also many developments distributed all over the system and important extensions and improvements at Southampton. On the London, Brighton and South Coast Railway the widenings and reconstruction of stations rank equally with the construction of the " Quarry " lines by which through trains can be worked independently of the South Eastern and Chatham Railway over the joint section through Redhill. The South Eastern and Chatham record is also a notable one, involving improvements at Victoria, new lines in the London Bridge district, the new Marine station at Dover, and improvements all over the system.

In the case of the Great Central Railway, ranking equally in regard to traffic importance and cost with the London extension and the joint line via High Wycombe, is the construction and opening of Immingham Dock in 1912. Similarly, in the King George Dock at Hull, the North Eastern and Hull and Barnsley Railways undertook and completed a notable undertaking.

And so, taking each railway in turn, it would be possible to review item after item in regard to new extensions, widenings, station reconstructions and improvements. But space forbids, and it is only possible to consider other aspects by brief reference to railway amalgamations and a few other events of historic interest, with an indication of certain further aspects of railway progress and development since 1897.

It was in that year that the Manchester, Sheffield and Lincolnshire Railway assumed the title of " Great Central Railway," in view of the approaching completion of the London extension. In 1899 the South Eastern and Chatham Railways' Joint Committee was set up. In 1900 the Waterford and Central Ireland Railway was taken over by the Great Southern and Western Railway, the Waterford, Limerick and Western Railway being also absorbed in 1901. In 1903 the Midland Railway took over the Belfast

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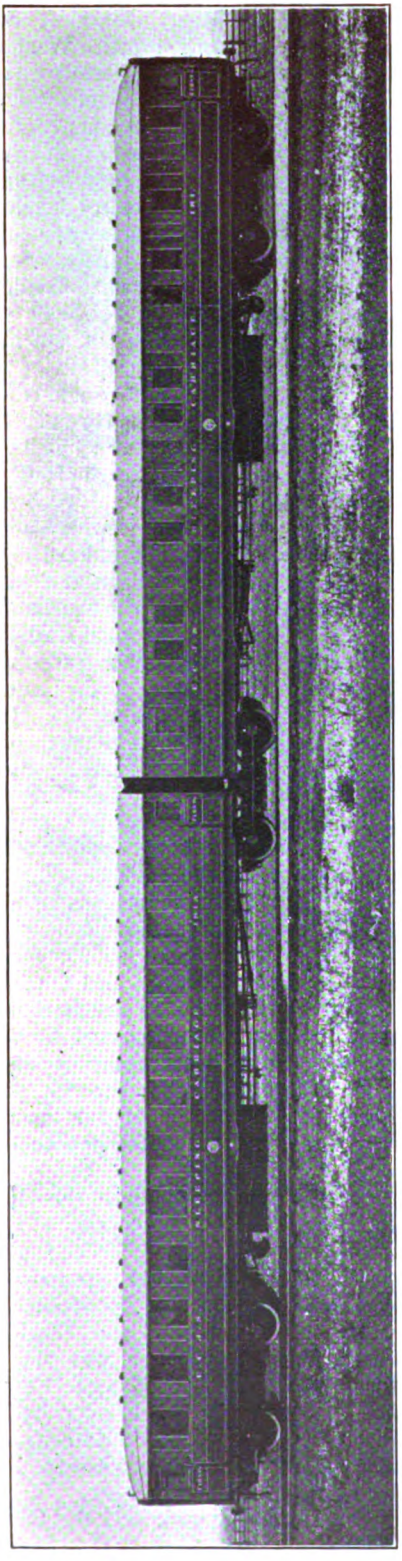

"ARTICULATED" SLEEPING CAR, EAST COAST JOINT STOCK.
Designed by Mr. H. N. Gresley, C.B.E., and built at Doncaster Works.

and Northern Counties Railway. In 1905 the Hull, Barnsley and West Riding Junction Railway and Dock Company became the Hull and Barnsley. In that year, also, the Great Central Railway headquarters were removed from Manchester to London. In 1906 the Harrow-Verney Junction section of the Metropolitan Railway was made joint with the Great Central Railway. In 1907 the Lancashire, Derbyshire and East Coast Railway was amalgamated with the Great Central Railway, the Dublin, Wicklow and Wexford Railway became the Dublin and South Eastern Railway, and the greater part of the Donegal Railway was taken over jointly by the Great Northern of Ireland and Midland (Northern Counties section) under the County Donegal Railways Joint Committee. In 1912 the London, Tilbury and Southend Railway was taken over by the Midland Railway, and in 1913 the Great Northern and City Railway by the Metropolitan Railway.

Traffic developments during the past 25 years have caused far-reaching and drastic changes in the railway situation in almost every direction. On the passenger side the new routes set up by the Great Western Railway render the facilities of 1897 almost incomparable with those of 1913 and of 1921-22 in regard to that railway; while in large manner the same can be said of other principal railways, owing to the construction of new lines here and there, introduction of through working arrangements, and the influences upon the train services of other railways exercised by the extension of the Great Central Railway to London. Special emphasis may be laid upin the now almost universal provision of restaurant cars and corridor carriages of bogie type, Pullman cars upon many lines, and through carriages providing a wide variety of through facilities, culminating in the introduction last year of direct communication without change of vehicle between Penzance, Plymouth and Aberdeen, Southampton and Edinburgh, &c.

In regard to traffic characteristics, too, there have been essential changes, notably in the abolition of second-class accommodation by all but a very few lines in England and Scotland, though it is still retained generally in Ireland and to some extent in Wales. Another feature of importance

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is the generous treatment of the half-day, day and period and long-distance excursionist, who in later years has been given facilities almost equal, in regard to speed and comfort of accommodation, to those associated with ordinary traffic.

These and other aspects of traffic development are covered by other writers in following articles, but a few statistics may be given, mostly in round figures, comparing 1897 with 1913 (the preferable year for several reasons) and with 1920.

Statistics given in the table below must speak for themselves, though they suggest some rather remarkable changes in several respects, not only as between 1897 and 1913 or 1920, but as between the two latter years, especially in regard to season tickets. It must be remembered, however, that whereas in 1897 and 1913 each railway having a share in a fare included the passenger in its returns, in 1920 he was only recorded once. It will be recalled also that in later years the mileage covered by season tickets has considerably increased, while in 1913 the tendency for local tramways, &c., to abstract suburban traffic from railways was strongly manifesting itself, though during and after the war years passengers returned to the railways in large numbers and there were many accessions.

In regard to freight traffic there are not so many changes statistically as might be expected, as will be seen from the comparisons given.

Here also the figures for 1920 include one record only, whereas in the two former years traffic was credited to each railway concerned.

This aspect may be completed by reference to receipts, expenditure and net receipts for the same three years, with the proviso that in 1920 the Government control of railways under guarantee conditions and the altered money values, and largely increased expenditure (and therefore gross receipts) figures vitiate correct comparison, so that the 1897 and 1913 figures are of chief interest as showing the development of railway business.

Developments in steam and electric locomotive practice, &c., are covered by subsequent writers, as also the many changes in operating methods, but the following rolling-stock totals for 1897 and 1920 will be of interest :—

	1897.	1920.
Steam locomotives ..	19,462	25,075
Electric locomotives ..	17	84
Rail motor cars	—	134
Coaching vehicles (not electric)	61,411	72,698
Coaching vehicles (electric, motor and trailer)	107	3,096
Goods and mineral vehicles..	632,330	762,271

In 1897 the 17 electric locomotives were all on the City and South London Railway, and 44 of the electric motor cars on the Liverpool Overhead, and two on the Bessbrook and Newry line, with the 54 trailer cars on the City and South

COMPARATIVE RAILWAY STATISTICS FOR 1897, 1913 AND 1920.

Numbers of Passengers.	1897.	1913.	1920.
First class	32,498,000	31,437,000	37,675,000
Second class..	62,763,000	13,579,000	7,488,000
Third class / Workmen's	935,160,000	1,094,833,000 / 314,912,000	1,096,585,000 / 462,743,000
Total..	1,030,421,000	1,454,761,000	1,604,491,000
Annual season tickets	1,286,588	737,819	1,037,614

Tonnage conveyed.	1897.	1913.	1920.
Merchandise..	107,469,000	121,360,000	72,613,000
Coal, coke, &c. / Other minerals	266,913,000	345,115,000 / 101,726,000	182,640,000 / 68,718,000
Total..	374,382,000	568,210,000	323,971,000

	1897. £	1913. £	1921. £
Gross receipts	93,737,000	139,451,000	267,414,000
Expenditure..	53,084,000	87,320,000	261,755,000
Net receipt	40,653,000	52,131,000	53,012,000

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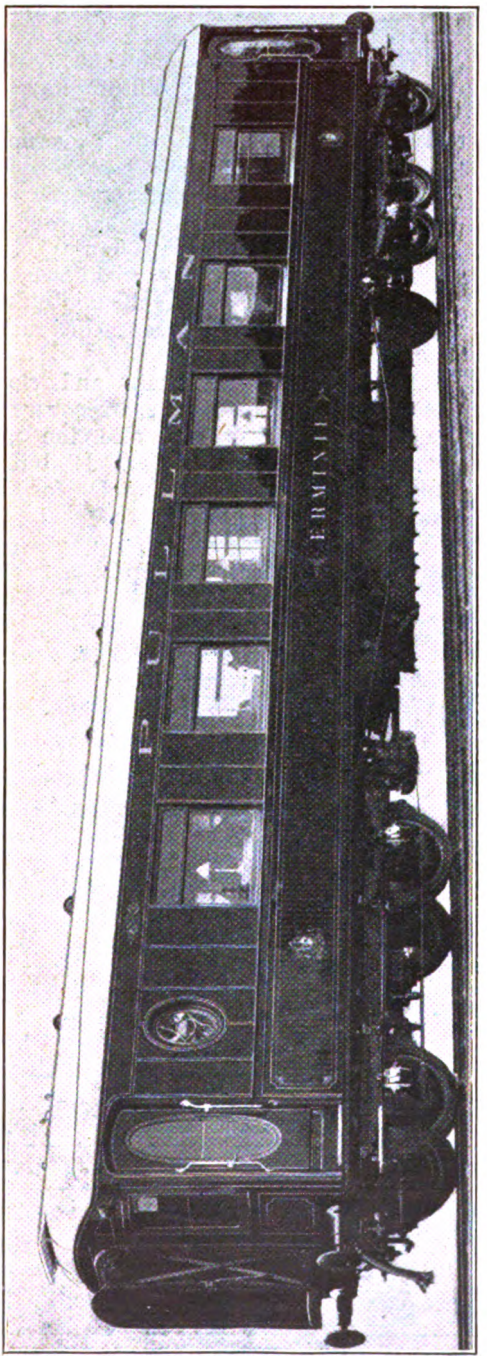
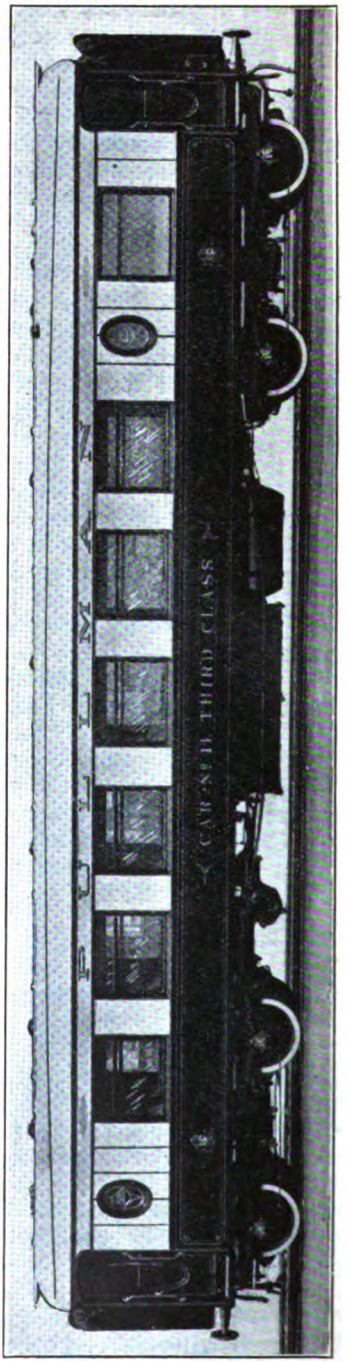


FIRST-CLASS PULLMAN CAR, SOUTH EASTERN & CHATHAM RAILWAY.



THIRD-CLASS PULLMAN CAR, LONDON, BRIGHTON & SOUTH COAST RAILWAY.

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London, and seven on the Liverpool Overhead.

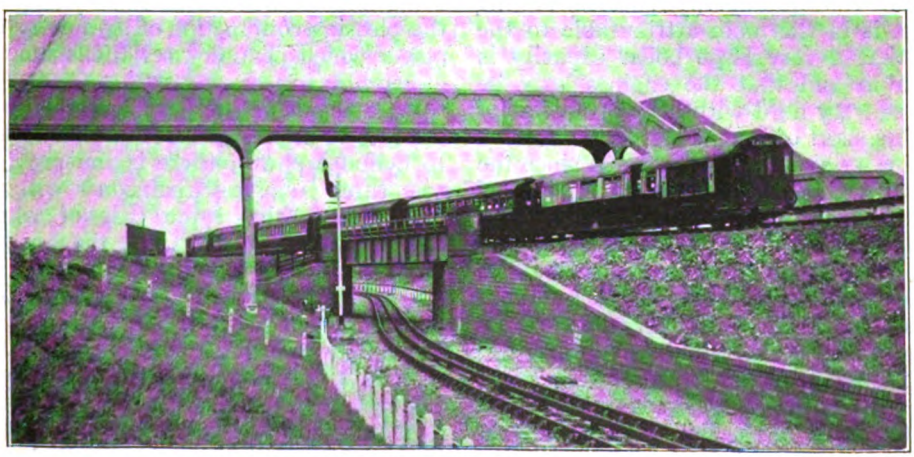
Another development which is associated almost entirely with the 25 years since 1897 is the now widespread employment of power for railway signalling with its special applications for automatic, semi-automatic and isolated signals.

Associated with actual railway enterprise are extensive developments in regard to railway-owned docks and equipment, steamships, the introduction of road motor services, &c., but these are covered in a later article. There are, indeed, many other phases of railway activity which could be dealt with at length, but space will permit.

In regard to the special services rendered by the home railways during the war period, these are now matters of historic record, though they constitute probably the finest evidence which could be adduced of the high standards of efficiency reached by British railways, and their officers and staff. And now that a new railway era is on the point of inauguration and many of the preliminary stages leading up to the great amalgamations (which, under the Railways Act, 1921, are to be completed next year) are completed or well under way, this same standard of efficiency, and the fact that so many of the men who "carried on" so well during the years of the war period, and the perhaps even more difficult years of 1919, 1920 and 1921, will continue at the helm, constitute the best auguries for the future of British railways under the new conditions which it will be the duty of the RAILWAY MAGAZINE to chronicle in the years to come.

STEAM RAIL MOTOR CAR AND TRAILER CAR, GREAT WESTERN RAILWAY.
Motor trains of this and other types have been extensively introduced on many lines since 1897.

A SCENE ON THE EALING AND SHEPHERD'S BUSH RAILWAY.



SHOWING CENTRAL LONDON RAILWAY ELECTRIC TRAIN, "FLY-OVER," UPPER QUADRANT AUTOMATIC SIGNAL, &c

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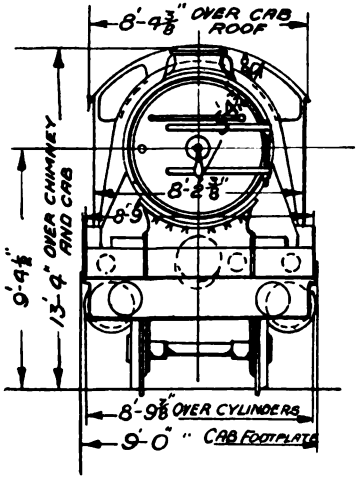

DIAGRAM OF FRONT END.

The New Great Northern "Pacific" Locomotive.

By CHAS. S. LAKE,
A.M.I.Mech.E., M.Inst.L.E.

FOR several years past the bulk of the express passenger train services on the Great Northern Railway have been handled by "Atlantic" type engines of the enlarged, or "No. 251" class, designed by Mr. H. A. Ivatt, and built at the company's works, Doncaster. These engines have proved themselves highly efficient in maintaining time with trains of considerable weight, and although as a matter of course their power is limited to the adhesion of four coupled wheels, thus making it difficult to excel on grades when weather and rail conditions are adverse, there has never been any difficulty from the point of view of cylinder tractive effort, or inability to supply all the steam required even when working with a late cut-off; indeed, the noteworthy success of the design is in the main attributable to the fact that a very large boiler capacity is available and that the engines can be worked very hard with little or no fear of running short of steam.

Some 11 years having elapsed since the last of the Atlantics was built, a good deal of conjecture has, quite naturally, been indulged in as to the form which any new passenger locomotive introduced by Mr. Gresley would take. At one time a rumour existed to the effect that an engine of the 2-6-2 type was being built at Doncaster, the adoption of this wheel arrangement being, it was said, largely consequent upon the fact that very high speeds, namely 70 miles and over, have been reached and maintained by the 2-6-0 type engines, particularly the "No. 1000" class. Later events have however proved that this rumour like so many others, was false, and now that the new passenger locomotive has materialised, it is seen to be of the "Pacific" or 4-6-2 type, of which, tank engines excepted, there has heretofore been only one example on British railways, viz.: *The Great Bear*, on the Great Western Railway.

The writer was informed by Mr. Gresley when the new engine was first being laid down at Doncaster of what its general characteristics would be, and consequently its main features and proportions had already been visualised by the former with tolerable accuracy. Nevertheless, on first seeing the locomotive the impression was somewhat different than anticipated, it being difficult to contemplate beforehand the pleasing conjunction of symmetry and power which characterises the locomotive in actual being.

An analysis of the design, even though brief, is of interest. First of all in regard to cylinder power, there is the provision of three single-expansion cylinders all driving the same pair of wheels, the inside one through the medium of a balanced crank axle, the three crank pins being set at a relative angle to one another of 120 deg. This arrangement does away with dead centreing and there is always a piston in position ready to take steam. A difficulty that arises with a three cylinder locomotive as distinct from one with two or four cylinders, is that of arranging for efficient steam

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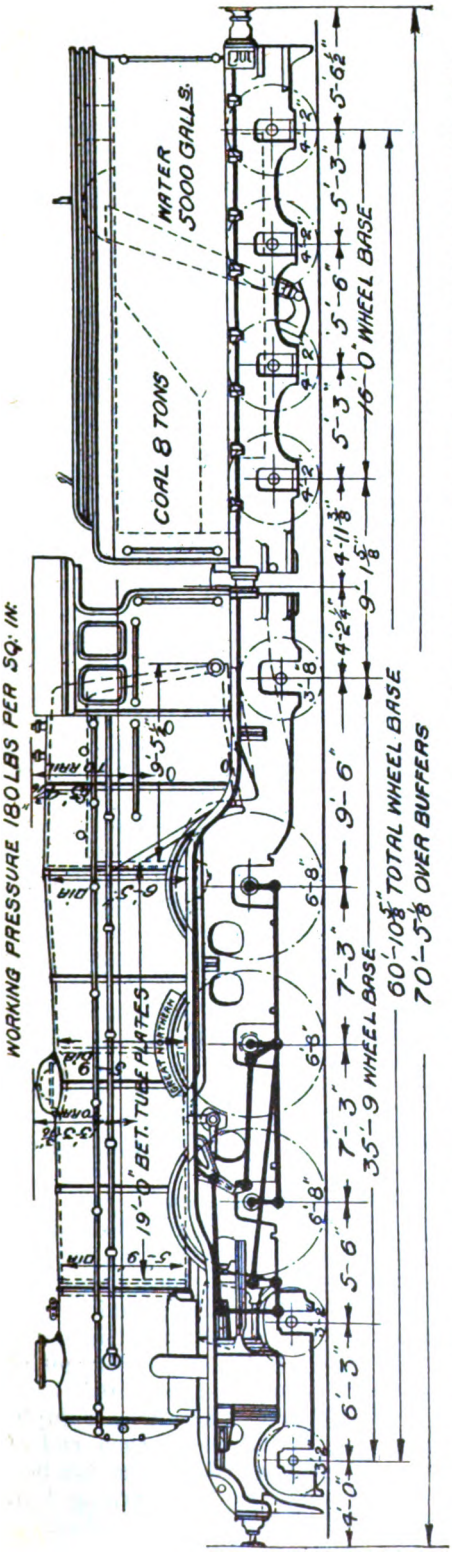

DIAGRAM AND PRINCIPAL DIMENSIONS OF THE NEW GREAT NORTHERN RAILWAY 4-6-2 THREE-CYLINDER LOCOMOTIVE NO. 1470.

distribution without utilising independent valve gearing for each cylinder. Readers of the RAILWAY MAGAZINE who are interested primarily in locomotives are doubtless well aware that Mr. Gresley, when introducing the "No. 1000" class, devised and patented an ingenious form of gearing by means of which the steam distribution for the inside cylinder is similar to that of the outside ones.

The valve motion of the outside cylinders is the ordinary Walschaerts' gear and the valve spindle of the inside cylinder is coupled to that of the two outside ones by a simple arrangement of levers working on a pivoted joint fitted with Hoffmann roller bearings. As in the other class referred to "Skefko" ball bearings are used for the return cranks. The connecting and coupling rods, also the piston head and rods, the latter being hollow, are made of nickel chrome steel heat-treated, which results in a considerable saving in weight as compared with carbon steel rods. The web portion of the rods has a thickness of only $\frac{5}{16}$ in., and the saving in weight is in some respects as much as 50 per cent. on ordinary practice.

It will be realised from the foregoing that in this engine there is an abundant cylinder volume and that the power instead of being concentrated in two very large cylinders with heavy reciprocating and revolving masses is distributed over three units each giving lighter impulses, and at the same time affording in the aggregate a greater output of tractive force. The outside cylinders are placed horizontally above the bogie and drive the middle pair of coupled wheels, the middle cylinder being at an inclination of 1 in 8 and located over the rear axle of the bogie, all three cylinders, as previously stated, driving the same pair of wheels.

Next we come to the boiler. This of necessity is very large, but at the same time it has been planned to avoid excessive length in the tubes, or in the firebox, whilst providing a very ample area of heating surface. The superheater is of large proportions, as also the grate, and the following ratios are illustrative of the manner in which the surfaces in contact with water and heat have been distributed :—

Total heating surface ..	3,455 sq. ft.
Total equivalent heating surface	3,717·5 ,,

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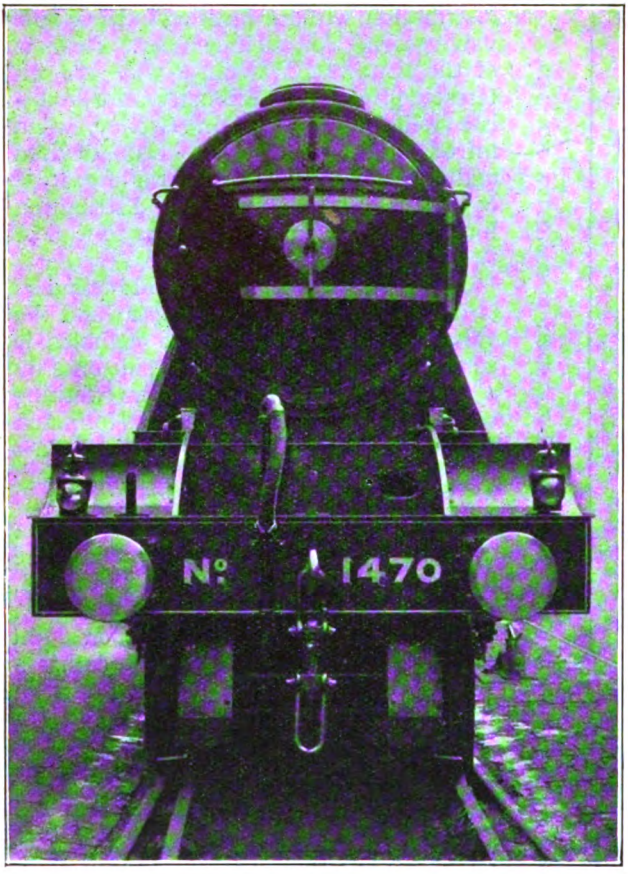

VIEW OF FRONT END.

Tractive effort—	
At 85 per cent. boiler pressure.	29,835 lb.
÷Total heating surface	8·635
÷Total equivalent heating surface.	8·025

$$\frac{\text{Tractive effort} \times \text{driving wheel diam. (in.)}}{\text{Equivalent heating surface}} = 642$$

The boiler barrel measures 19 ft. between tube plates. It has a tapered ring next the firebox, whilst the crown plate of the latter slopes downward towards the cab, thus providing a truncated form of construction, ensuring the maximum of cross-sectional area immediately adjacent to the firebox where the heat values are naturally greatest, and by virtue of the sloping crown ensuring a sufficiency of water above the firebox when the engine is pointing downhill. The boiler barrel measures 6 ft. 5 in. diam. at its largest part and tapers down to 5 ft. 9 in. diam. just behind the steam dome, continuing forward in parallel formation until it joins the smoke-box. The firebox casing at the front is 6 ft. 6 in. diam., and tapers down to 6 ft. 1 in. wide at the back. The firebox is 9 ft. 5½ in. long above and 6 ft. 8 in. long by 7 ft. 9 in. wide at the bottom. The firebox is extended into the barrel of the boiler, the effect of this extension being to reduce the length of the tubes and increase the fire-box heating surface. It further acts as a combustion chamber and is therefore conducive to more complete combustion.

The boiler is equipped with the "Robinson" superheater, having 32 elements, *i.e.*, four rows of eight:—the ordinary fire tubes being massed mainly below and partly at the sides of the superheater flues. Two "Ross" safety valves, each 4 in. in diam. are mounted upon the firebox, these being loaded for a pressure of 180 lb. per square inch. Wakefield mechanical lubricators are employed for the steam chests and cylinders in conjunction with the same firm's anti-carbonising device, a separate Wakefield lubricator being provided for the coupled wheel axle-boxes. The trailing wheels are fitted with axle-boxes of the "Cartazzi" type, having a side translation radially of 2½ in. each way, whilst sufficient side play is provided in the leading bogie to allow the engine to pass round a curve of four chains radius.

The design of the cab constitutes a new standard in Great Northern locomotive practice. It is fitted with an extended roof and has windows at the sides. It is very wide and roomy, and speaking from experience, the writer can say it is one of the best arranged and most convenient footplates yet placed on a British locomotive. The regulator handles are duplicated, being mounted one at each end of a cross shaft supported on the fire-box backplate, the handles being arranged to pull upward. A very clear outlook is

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afforded by means of the front windows, and padded seats are available for both driver and fireman. Power reversing is included.

The tender is mounted upon eight wheels without bogies. It has a water capacity of 5,000 galls., and a coal capacity of 8 tons. The only criticism that was to be heard during the inspection of the locomotive at King's Cross on April 6 was directed against the wheel arrangement of the tender, it being urged that an eight-wheeled tender should have its wheels arranged in the form of bogies. Experience of some such tenders, however, has shown that under certain and by no means infrequent conditions the greater flexibility of the bogie system has led to the throwing of coal from the tender owing to the increased oscillatory movement of the tender superstructure. It will be noted that the wheel-base of the new Great Northern tender is by no means excessive, and no disadvantage is to be anticipated in practice from use of the rigid axles.

VIEW LOOKING FORWARD.

The main particulars of the locomotive are as follow:—

Cylinders (three) diam. ..	20 in.
Piston stroke	26 in.
Centre to centre of outside cylinders.	6 ft. 8½ in.
Coupled wheels, diam. ..	6 ft. 8 in.
Bogie wheels, diam. ..	3 ft. 2. in.
Trailing wheels, diam. ..	3 ft. 8 in.
Wheelbase—	
Rigid	14 ft. 6 in.
Total engine	35 ft. 9 in.
Total engine and tender	60 ft. 10⅝ in.
Boiler heating surfaces—	
Fire-box	215 sq. ft.
Tubes (small) ..	1,880 ,,
Tubes (large)	835 ,,
Total	2,930 ,,
Superheater, heating surface	525 ,,
Total	3,455 ,,
Grate area	41·25 sq. ft.
Working pressure ..	180 lb. per sq.in.

The following particulars show briefly how the new engine, No. 1470, compares with the "Atlantics" now running:—

	"Atlantic" type.	"Pacific" type.
Diameter of coupled wheels	6 ft. 8 in.	6 ft. 8 in.
Cylinders—		
Number	Two	Three
Diameter	20 in.	20 in.
Stroke	24 in.	26 in.
Boiler—		
Total heating surface	2,533 sq. ft.	3,455 sq. ft.
Grate area	31 sq. ft.	41¼ sq. ft.
Diameter	5 ft. 6 in.	6 ft. 5 in.

The introduction of this engine No. 1470 after a lapse of 11 years, during which no engines intended for express passenger work alone, have been built at Doncaster, is one of the most interesting developments in locomotive practice that has taken place of late. Since the last of the "251" class "Atlantic" engines were built in or about the year 1911, there has been an

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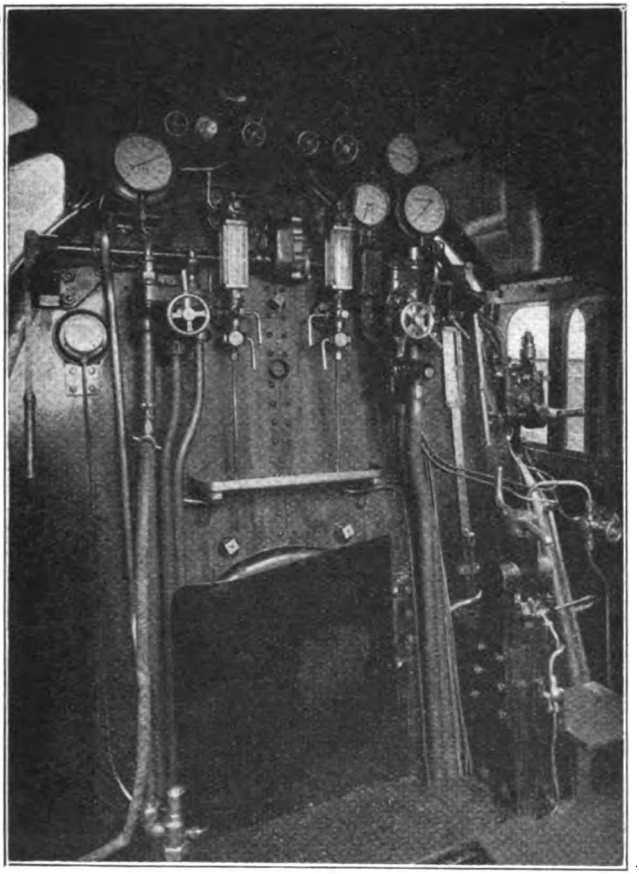

FOOTPLATE VIEW.

increasing necessity on the Great Northern for a locomotive of greater power than could be obtained with the four wheels coupled arrangement, and this fact, combined with the success of the three cylinder system in express goods service, led to the adoption of the 4-6-2 type with three cylinders for express passenger service.

The weight distribution of the locomotive has been gone into most carefully. There are 60 tons of adhesion, (20 tons on each coupled axle), 17 tons 1 cwt. on the leading bogie, and 15 tons 8 cwt. on the trailing wheels, a total of 92 tons 9 cwt. for the engine alone in working order. The tender in working order weighs 56 tons 6 cwt. distributed as follows:—

On leading wheels	13 tons 4 cwt.
On second pair of wheels ..	14 tons 19 cwt.
On third pair of wheels ..	14 tons 14 cwt.
On trailing wheels	13 tons 9 cwt.

The tender is fitted with water pick-up apparatus.

A second engine of the same class is at present in hand at the Doncaster works. They are classed "A1" in the books of the company.

The Railway Magazine for July, 1922

Will commence the 51st Volume, and also be a

SPECIAL SUMMER NUMBER.

LOCOMOTIVE AND TRAIN WORKING IN THE LATTER PART OF THE NINETEENTH CENTURY.

Under this heading Mr. E. L. Ahrons will deal with the Locomotives of the BRECON & MERTHYR RAILWAY.

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British Locomotive Practice, 1897-1922.

By CECIL J. ALLEN, A.M.Inst.T., A.I.Loco.E.

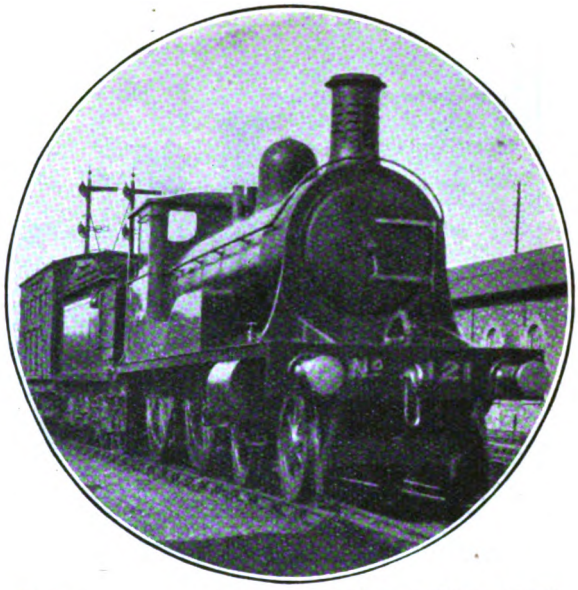

Photo.] [*E. A. Gurney-Smith.*

HIGHLAND RAILWAY.

Old 4-4-0 engine, No. 121 ("Loch" class.)

TO compress into one brief article a survey of the developments which have taken place in the design of British locomotives during the course of a quarter of a century is no easy task; it is a case for study of broad outlines rather than minute attention to detail. If we consider the career of the steam locomotive, as a successful medium of railway traction, to have commenced at the Rainhill trials of 1829, the period of our review may be taken as covering a little over one quarter of British locomotive history.

About the time when the first issue appeared of the RAILWAY MAGAZINE—in July, 1897—a new era in locomotive design was beginning in this country. During the closing years of the nineteenth century there had been a tendency to confine locomotive improvements to enlargements of cylinders, without commensurate increases in boiler capacity. To take one well-known example, Patrick Stirling had just built in 1895 his final batch of 8 ft. "singles" for the Great Northern Railway, and in them had increased his cylinder dimensions from the 18 in. by 28 in. of the earlier engines to 19½ in. by 28 in., while retaining his small boiler practically without alteration. Coal was in those days comparatively cheap, and thrashing of the engines at times was not therefore a matter of serious expense or moment. So over-cylindering was becoming common, and a crying need was arising for power, as distinct from facilities for translating it into useful work—that is, for larger and more efficient locomotive boilers.

In 1897 the tide was definitely on the turn in this direction, and the movement probably owed its inception in large degree to the work of Mr. McIntosh's Caledonian 4-4-0 "Dunalastairs" in the race to Aberdeen of 1895. So epoch-marking a design was this, indeed, that when, in 1898, the enlarged "Dunalastairs" appeared, the modified type was taken as a pattern—presumably as representing the most efficient British locomotive then extant—by the Belgian Government in the following year, and the "Dunalastair" engines supplied at that time by Scottish firms for service in Belgium have undoubtedly influenced locomotive designs on the Belgian State Railways ever since. Curiously enough, when the Western section of the French State Railways required additional locomotive power in 1909, it was again to a Scottish railway that they turned for a design, Mr. Peter Drummond's 4-6-0 "Castle" class being the type selected, and again a Scottish firm was employed to supply the 50 engines needed.

The movement in these islands in favour

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Photo.] GREAT NORTHERN RAILWAY. [*R. Hall.*

Outside-cylinder 4-4-2 engine, No. 988 (Mr. Ivatt's "990" class), on down express.

of larger boilers received considerable impetus from Mr. Ivatt's first Great Northern "Atlantic" design in 1898—No. 990—and from the inside cylinder engines of the same wheel arrangement introduced by Mr.—now Sir—J. A. F. Aspinall on the Lancashire and Yorkshire Railway in the following year; there soon followed the Worsdell passenger 4-6-0's of Class "S" on the North Eastern Railway, also in 1899, Mr. Dean's first passenger 4-6-0 on the Great Western Railway—No. 100, now 2900—in 1902, Mr. McIntosh's 4-6-0 No. 49 on the Caledonian in 1903, and Mr. Ivatt's large-boilered "Atlantic" No. 251 in the same year, in which two last

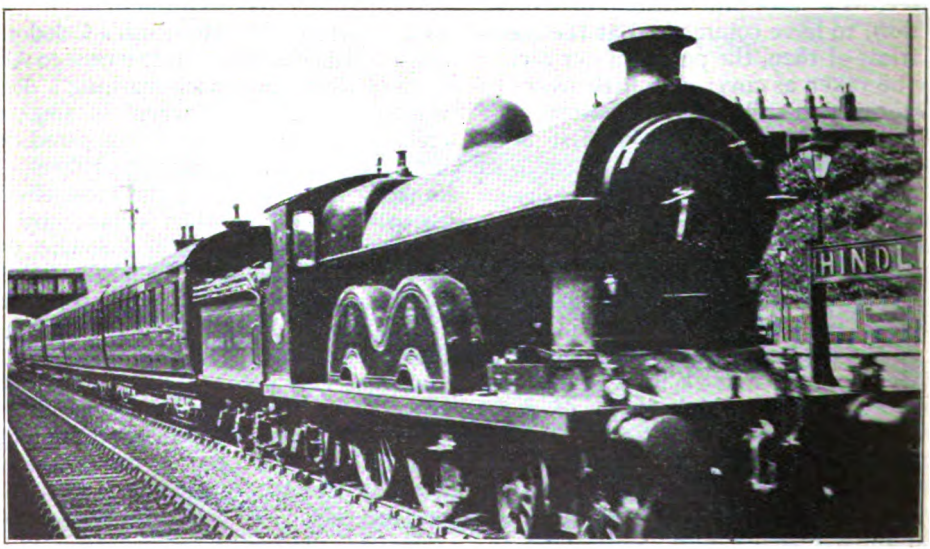

Photo.] LANCASHIRE & YORKSHIRE (now L. & N.W.) RAILWAY. [*H. J. Salmon.*

Inside-cylinder 4-4-2 engine, No. 1396 (Sir J. A. F. Aspinall's "1400" class), on Bradford express.

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examples boiler diameter had advanced for the first time in Great Britain to the large figure of 5 ft. 6 in. In the first half—roughly—of the period under review, the average relation of steam-producing to steam-utilising capacity in British locomotives thus gradually underwent a considerable change, as cylinder capacity during this period had not increased in anything like the same degree as boiler and firebox dimensions.

In 1908, a new locomotive era was inaugurated here by the introduction of superheating, and this has brought about, by slow degrees, a reversion, dimensionally, to the previous relation between cylinders and boiler. By the year mentioned, the application of superheating equipment to locomotives was already in considerable vogue on the Continent of Europe, but the moderate temperature superheater fitted by Mr. Churchward to his Great Western Railway 4-6-2 express engine *The Great Bear* in 1908 was the first example in this country. It is probable, however, that superheating received its greatest testimonial in the British Isles from the through running in 1909 of Mr. Earle Marsh's London, Brighton and South Coast express tank No. 23 in competition with the London and North Western "Precursor" 4-4-0 No. 7, *Titan*, between Brighton and Rugby. The Brighton engine had been newly built in 1908, and was one of a batch of six fitted with Schmidt superheaters. That a tank engine with a water capacity of just over 2,000 gallons should be capable of completing a journey of 77·2 miles without any intermediate stoppage, or any means of taking water *en route*, when hauling a corridor express of some 230 to 250 tons weight at an average speed of 52·6 m.p.h., was a thing then unheard of. The limited consumption of fuel, as well as of water, by No. 23 in these trials spoke too loudly to be ignored, and since then locomotive superheating in this country has never looked back. To-day practically every new British locomotive type designed for continuous steaming is superheater-equipped, and also many tank types for suburban service, while innumerable engines of earlier types have, during the last ten years, been rebuilt, and their efficiency greatly increased, by the addition of superheating apparatus.

Photo.] CALEDONIAN RAILWAY [*W. A. Millar.*

Pullman Car express entering Princes Street Station, Edinburgh.
4-4-0's Nos. 772 (second "Dunalastair" class, rebuilt) and 892 (third "Dunalastair" class).

Compounding, however, has had a far less successful career. The year 1897 saw large numbers of 3-cylinder Webb compounds at work on the London and North

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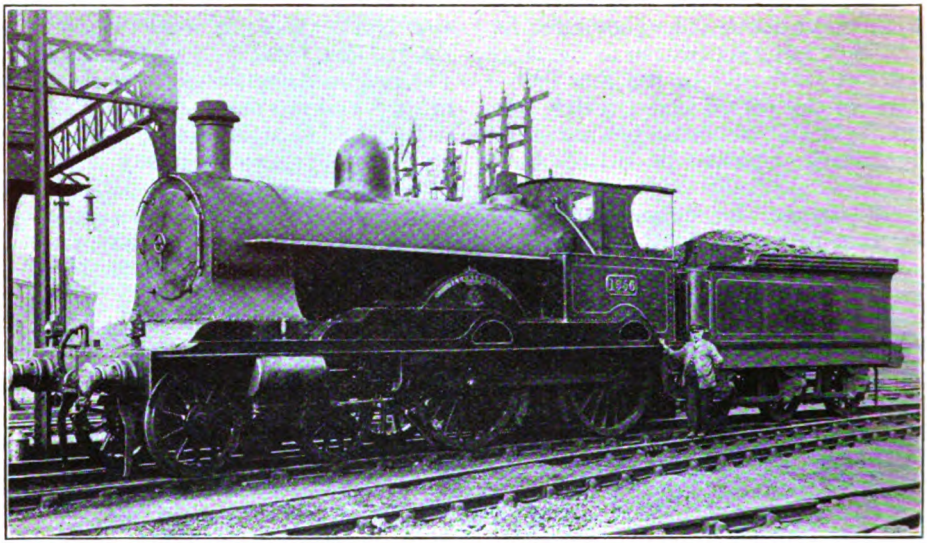

Photo.] LONDON & NORTH WESTERN RAILWAY. [*P. F. Cooke.*

Four-cylinder Webb compound engine, No. 1956, "Illustrious," as fitted by Mr. G. Whale with outside valve gear.

Western Railway, and between then and the close of the Webb *régime* in 1906 some 250 further compound engines of 4-cylinder types—eighty 4-4-0 express passenger, thirty 4-6-0 mixed traffc, and the majority of 180 eight-coupled mineral engines—were built at Crewe. But it is a sufficient commentary on the radical defects of the Webb system that, on the retirement of Mr. F. W. Webb from the locomotive superintendence of the London and North Western Railway, it was a rule definitely laid down that every express exceeding the equivalent of 17 six-wheeled coaches, or say, 250 tons at most,

Photo.] LONDON & NORTH WESTERN RAILWAY. [*J. Macartney Robbins.*

"Precedent" class 2-4-0 engine, No. 1668, "Dagmar," piloting "Precursor" class 4-4-0, No. 2576, "Arab."

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must be piloted, even over the easy gradients of the bulk of the North Western main line. To-day, sixteen years later, there are very few Webb compounds still in existence. The Worsdell-von-Borries 2-cylinder system was in use to a limited extent on the North Eastern Railway in 1897, as well as on the Northern Counties Railway of Ireland; but all the engines so equipped on the former line were converted to simple propulsion in the early years of the era now under review.

The possibilities of compounding were, however, amply demonstrated by the three-cylinder compound 4-4-0 express

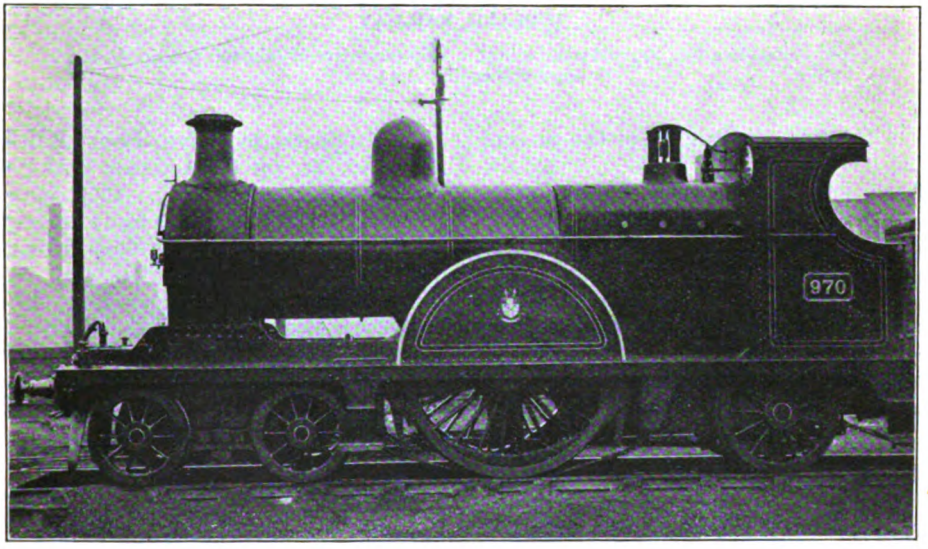

Photo.] GREAT CENTRAL RAILWAY. [*P. F. Cooke.*

"Pollitt" single locomotive built for working London express trains, now used between Liverpool and Manchester.

design introduced by Mr. S. W. Johnson on the Midland Railway in 1902, subsequently modified by his successor, Mr. R. M. Deeley, and multiplied to a total of 45 engines, all of which are still at work, and most successfully. Further interest was stimulated in locomotive compounding by the purchase in 1903 by the Great Western Railway of the French-built four-cylinder de Glehn compounded "Atlantic" engine *La France*, of the type then achieving such distinction on the exceedingly fast express services of the Northern Railway of France. Two years later there was quite an outbreak of compound locomotive activity in England, two more French "Atlantics" arriving for service on the Great Western Railway, while experimental 4-4-2 engines were also built for the Great Northern Railway, of three different types, and on the Smith system for the Great Central Railway and the North Eastern Railway. Later on, in 1907, Mr. Hughes designed and built 20 four-cylinder balanced compound 0-8-0 engines of a modified de Glehn arrangement, for mineral service on the Lancashire and Yorkshire Railway.

With the possible exception of the Great Northern engines, which could pull anything in the way of load but never displayed any capacity for speed, all these compound engines have done well on a performance basis, and have generally been favourites with their drivers as well, which is quite a satisfactory test; further, the work of all the express engines mentioned in the last paragraph has been improved still further in recent years by the addition of superheating equipment. Nevertheless, constructional, maintenance and royalty costs, in addition to the spectre of "complication," have been put forward as reasons for not continuing the building of compound locomotives in Great Britain. This is a matter for an argument which cannot possibly be entered

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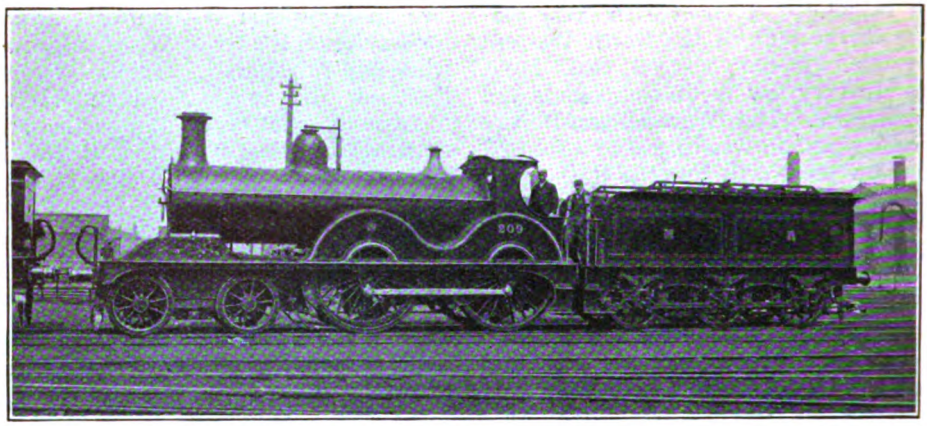

MIDLAND RAILWAY

4–4–0 locomotive No. 209 (old numbering). Representative of Midland practice in 1897, when this engine was built.

into in the limited confines of the present article.

If multi-cylinder compound locomotives have not increased in numbers to any appreciable extent in the British Isles during recent years, however, the same could not be said of divided cylinder arrangements in the case of single expansion or simple engines. The first British engine with four simple cylinders—if we except the Sturrock "steam tenders" of 1864—appears to have been Manson's 4-4-0 No. 11, on the Glasgow and South Western Railway, in 1897. Close upon its "heels," (or would it be more correct to say "buffers"?) came Webb's first 4-4-0 *Iron Duke*, of the London and North Western Railway, built as a four-cylinder simple, but very soon afterwards converted to compound propulsion. In the following year came Drummond's No. 720 on the London and South Western Rail-

Photo.] **MIDLAND RAILWAY.** [*Chas. S. Lake.*

Down goods train passing Bedford Central Running Sheds. Old 2–4–0 as pilot. Old single locomotive on shed line.

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way, nominally of the 4-4-0, but really of the 4-2-2-0 type, as the two pairs of driving wheels, each operated by distinct pairs of cylinders, both were, and still remain, uncoupled. All these early engines were, however, hopelessly over-cylindered in proportion to the size of the boilers that furnished them with steam, in accordance with the tendency of the period already referred to; the four cylinders of the Glasgow and South Western engine, for example, were 14½ in. diam. by 26-in. stroke, and of the London and South Western engine as much as 15 in. by 26 in.

It was not until the enormous Drummond "330" class of 1905 that a divided cylinder arrangement was seen in company with a boiler of adequate steam-raising capacity. There soon followed Mr. Churchward's four-cylinder "Atlantic," No. 40, *North Star*, subsequently converted to the 4-6-0 arrangement of wheels, and re-numbered 4000, forming the precursor of that remarkable and numerous "Star" class of express engines on the Great Western Railway, the fame of whose exploits on the road is by now proverbial. Later on there came into being the various four-cylinder types which are to-day so familiar, culminating in the remarkable four-cylinder 10-coupled engine designed by Sir Henry Fowler, and built at Derby in 1920, for banking trains up the 1 in 37 of the Lickey incline on the Midland West of England main line.

The vogue of three equal cylinders taking steam at high pressure began with Mr. James Holden's historic 0-10-0 *Decapod* on the Great Eastern Railway in 1903. Five years elapsed before any further three-cylinder simple engines appeared, and they were the 0-8-4 tank engines designed by Mr. Robinson for operating the Great Central Railway gravity marshalling yard at Wath, near Barnsley. The year 1909 saw the inception of Mr. Wilson Worsdell's 4-8-0 tank engines on the North Eastern Railway, also built for marshalling service, in which, of course, the even turning moment of three cylinders, with cranks set at 120 deg., is of considerable value. Subsequently Mr., now Sir, Vincent Raven, greatly extended the use of three simple cylinders on the North Eastern Railway, six different classes of engine on that railway—4-4-2 express passenger, 4-6-0 express goods, 0-8-0 mineral, 4-4-4 passenger tank, 4-6-2 mineral tank and 4-8-0 marshalling tank—being now so equipped.

Meanwhile, Mr. Gresley, on the Great Northern Railway, produced his three-cylinder 2-8-0 in 1918, and in its design for the first time overcame the objection

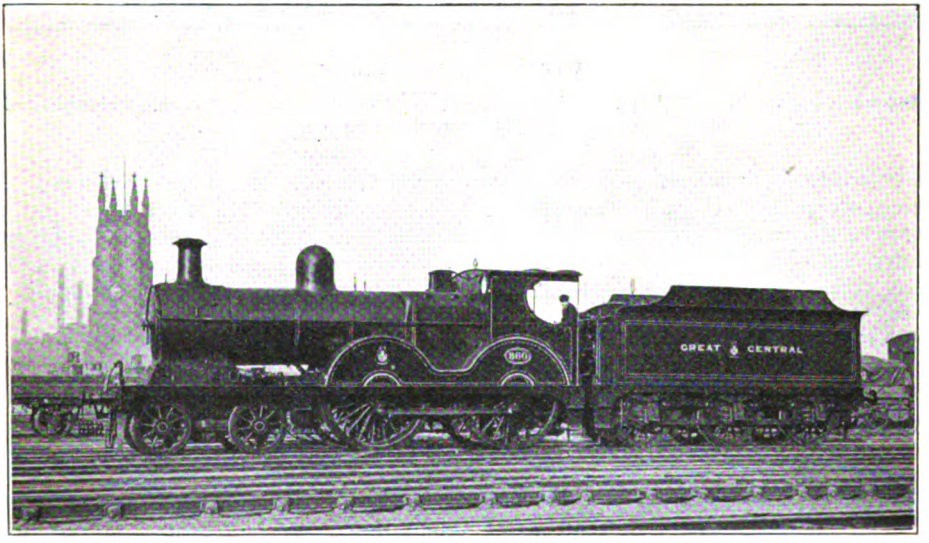

Photo.] GREAT CENTRAL RAILWAY. [*P. F. Cooke.*

Pollitt 4-4-0 locomotive (rebuilt), of the class used when the London extension was opened.

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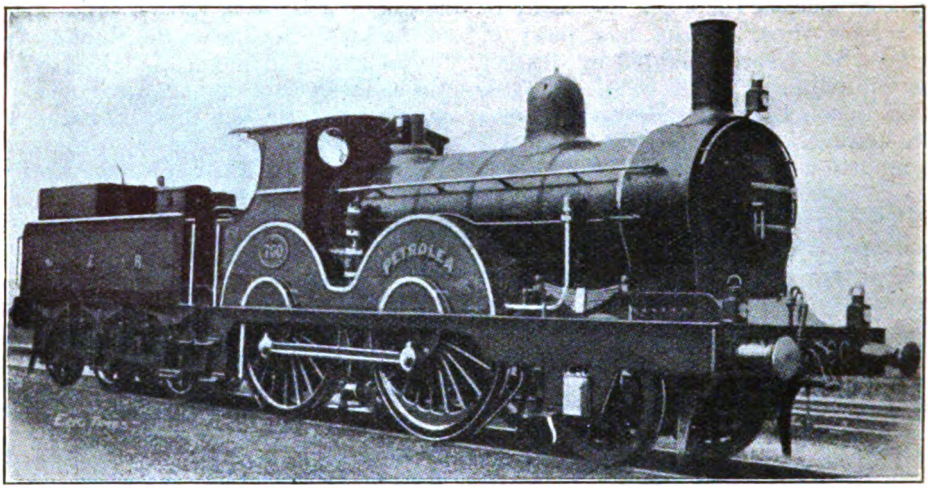
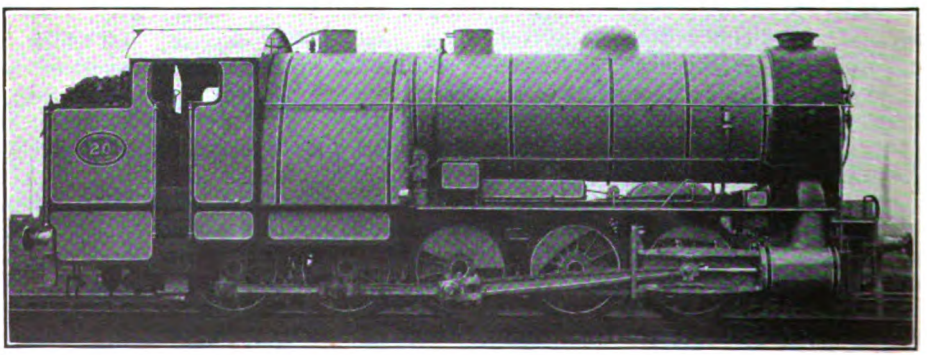


GREAT EASTERN RAILWAY.

2–4–0 locomotive, No. 760 "Petrolea." Burning oil on the Holden system, but with rectangular oil tanks, others having cylindrical tanks on top of the tender.

raised to three-cylinder simple propulsion on the score of the three sets of valve-gear in place of the two sets employed by four-cylinder engines, by deriving the valve motion for his inside cylinder from the two outside valve-gears; the same principle obtains in his 2-6-0 "1000" class of 1920, and has now been embodied in his magnificent new "Pacific" express passenger locomotive, No. 1470, which forms the subject of the frontispiece to this number of the RAILWAY MAGAZINE. Three-cylinder simple propulsion with derived motion for the inside piston-valve is also a feature of the first Scottish multi-cylinder engine of any type—Glasgow and South Western No. 11 alone excepted—Mr. Pickersgill's three-cylinder 4-6-0 on the Caledonian Railway. The largest cylinder dimensions yet attained within the restrictions of the British loading gauge are the 22 in. by 28 in. of the London, Brighton and South Coast 4-6-4 express tanks, introduced in 1914, and Mr. Urie employs the same large dimensions in his 4-6-0 engines of the "736" series, built in 1918, and other locomotives. Indeed, the London and South Western Railway is the only British line that has definitely reverted from multi-cylinder propulsion to the use of two cylinders only.



GREAT EASTERN RAILWAY.

Mr. Holden's famous "Decapod." This engine was built for experiment only; it had three cylinders and many special features.

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From cylinder arrangements we pass to the developments which have taken place in the arrangement of wheels during the past 25 years. It is interesting to reflect that in 1897 the "Atlantic" was unknown in these islands, and that the London and North Western Railway could not so much as claim one 4-4-0 engine; the 4-6-0 wheel arrangement was confined to a few goods engines designed and built for the Highland Railway by Mr. David Jones in 1894. Among tender goods engines there were none with eight-coupled wheels save the earliest of Webb's mineral engines, both simple and compound, of the 0-8-0 type; "Consolidations" were unheard of, and the 2-6-0, or "Mogul" arrangement, which had previously been tried on the Great Eastern Railway and elsewhere, had survived only on the Midland and South Western Junction Railway. As regards tank engines there were no 2-6-2, 4-6-2, 2-6-4, 4-4-4, 4-6-4, 0-8-0, 2-8-0, 0-8-2, 4-8-0 or 0-8-4 locomotives on any of the leading lines. Main line passenger working was mostly in the hands of 2-2-2, 4-2-2, 0-4-2, 2-4-0 and 4-4-0 engines; goods and mineral traffic was worked all but exclusively by 0-6-0 engines; local passenger work, shunting and marshalling were carried out principally by 0-4-4, 2-4-2, 0-6-2 and 0-6-0 tank engines.

The last single-driver engines built for service in this country made their appearance in the years 1898 and 1900 on the Great Eastern and Great Northern Railways in the former year, and the Great Central and Midland in the latter, and were all of the 4-2-2 type. Of these the Great Northern and Great Eastern types mentioned, together with the numerous single-driver engines of previous classes then in existence on those lines, and the Great Western and London and North Western Railways, have all since been broken up; the Great Central engines, built to work the express services over the newly-opened London Extension, are now relegated to the Cheshire Lines services, and the various Midland and North Eastern types of singles are fast reaching the scrap-heap. The one London and North Western exception, however, is the 8-ft. 6-in. 2-2-2 *Cornwall*, which, at the ripe age of 75 years is, like Charley's Aunt, "still running," on the chief mechanical engineer's saloon, and last year proudly piloted no less a celebrity than the four-cylinder 4-6-0 "Claughton" *Patriot* to Crewe on the afternoon "Scotsman." Nevertheless, the day of

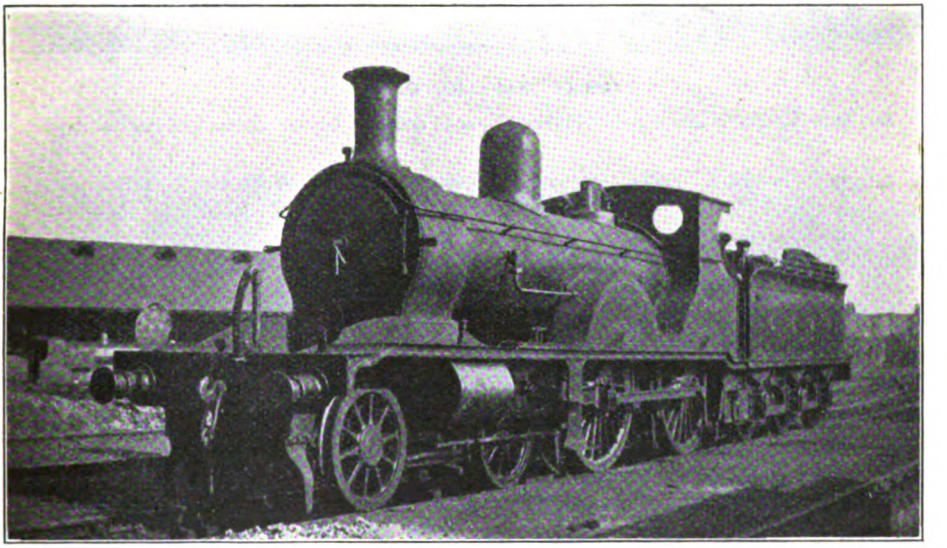

Photo.] **LONDON & SOUTH WESTERN RAILWAY.** [*F. H. Stingemore.*

Adams 4–4–0 engine No. 665 (fitted with Drummond chimney.)

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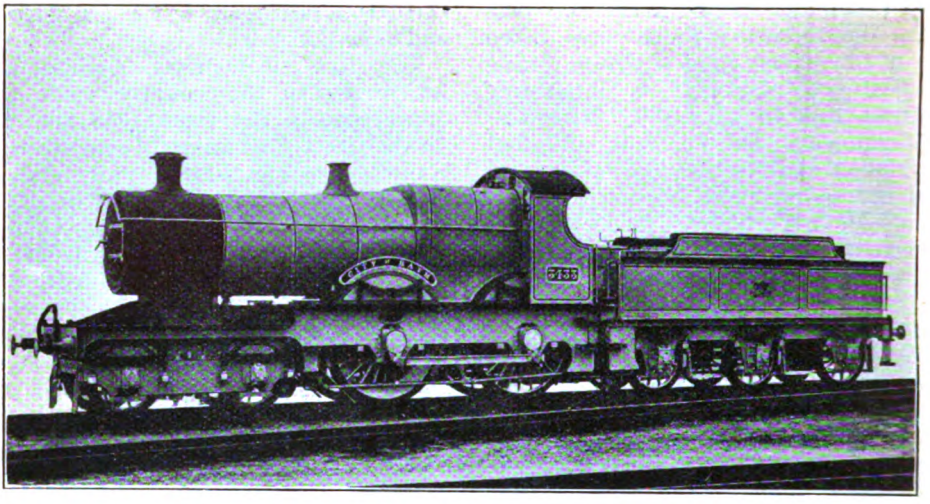
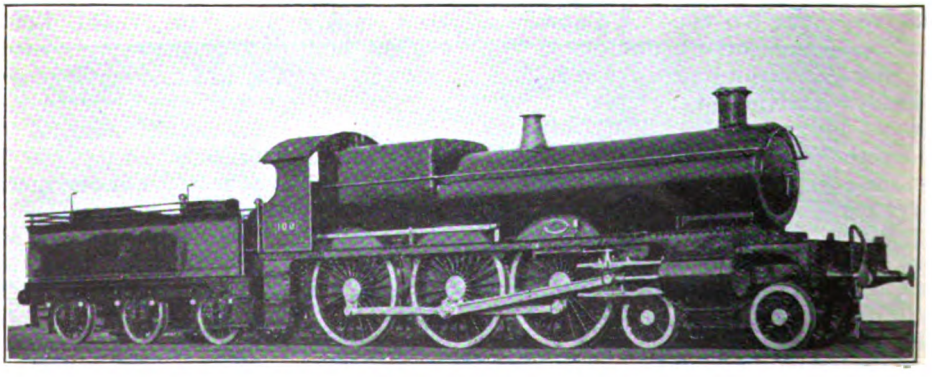


GREAT WESTERN RAILWAY.

Mr. Dean's 4-4-0 "City of Bath" (as built), one of the most famous engines of a famous class.

the "single" is now definitely at an end.

Ivatt's first Great Northern Railway "Atlantic"—the logical development of the 4-2-2 wheel arrangement, and the first 4-4-2 express engine in the country—was built in 1898, and followed by Aspinall's inside cylinder Lancashire and Yorkshire "Atlantic" in the following year. Five years then elapsed before the large-boilered Great Northern Railway 4-4-2, No. 251, destined, with the subsequent addition of superheating apparatus, to be the standard Great Northern design for express work for 22 years, made its appearance. In the same year were built the first North Eastern, Great Central and Great Western "Atlantics"; in 1905 the first London, Brighton and South Coast "Atlantics" appeared, and the North British 4-4-2's of 1906 brought the third and last of the East Coast companies into line with its partners. It is worthy of note that, whereas the North Eastern "Atlantics" represented a definite reversion from six-coupled to four-coupled wheels for the hardest passenger work, on three of the other "Atlantic"-using lines—the London, Brighton and South Coast, Great Central, and now, at long last, the Great Northern—the latest main line passenger designs have six-coupled wheels, while a fourth—the Great Western—long since abandoned the 4-4-2



GREAT WESTERN RAILWAY.

No. 100 (now No. 2900 "William Dean") as first built.

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arrangement of wheels, and converted all the "Atlantics" to 4-6-0's, except the French compounds.

In 1897, as previously mentioned, there was not a single 4-6-0 passenger engine in use in the country. Mr. Wilson Worsdell led off in this direction on the North Eastern Railway in 1898, and later, as we have just seen, reverted to four-coupled wheels; then came Mr. Peter Drummond on the Highland, with his "Castle" class, in 1899; while Mr. Churchward followed up Dean's experimental goods 4-6-0 of 1897 by bringing out his 6 ft. 8-in. express engine, No. 100 these were followed in 1906 by Coey's 4-6-0 mixed traffics on the Great Southern and Western Railway of Ireland—the earliest 4-6-0 engines of any type seen in the Emerald Isle. Since then numerous 4-6-0 engines with small diameter wheels have been built specially for mixed traffic service, especially by the London and North Western, North Eastern, Great Central and Caledonian Railways, while the early 6-ft. 4-6-0 express engines of the North Eastern and London and South Western Railways are also now confined entirely to similar work.

Another popular arrangement of wheels

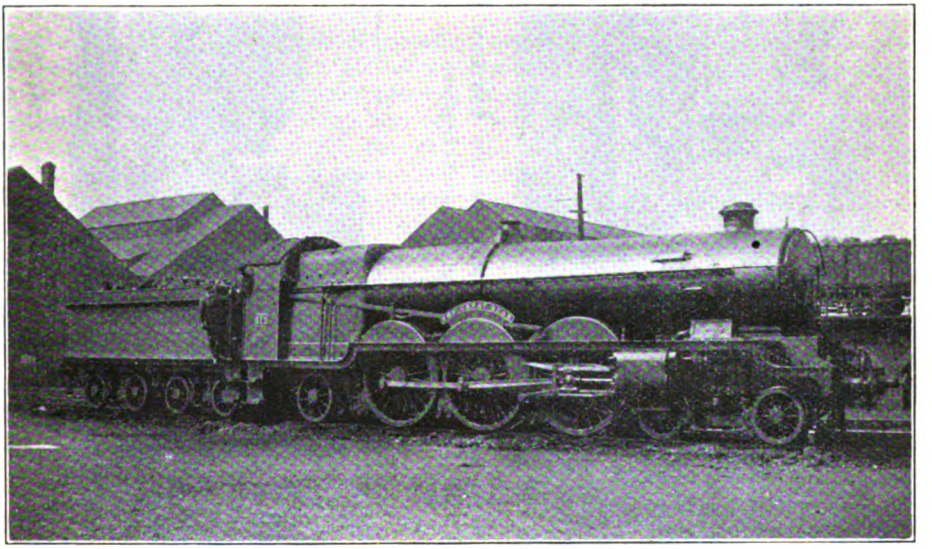

Photo.] GREAT WESTERN RAILWAY. [*F. H. Stingemore.*

4-6-2 locomotive, No. 111, "The Great Bear," recently fitted with "top-feed" and other alterations.

(now 2900) in 1902. After this the movement spread to the Caledonian and Glasgow and South Western Railways in 1903, the Great Central Railway in 1904, the London and North Western and London and South Western Railways in 1905, the Lancashire and Yorkshire Railway in 1909, the Great Eastern Railway in 1912, and, finally, to the Great Southern and Western Railway of Ireland in 1916. Contemporaneously, the 4-6-0 arrangement of wheels has been developed extensively for mixed traffic purposes; the Webb four-cylinder 5-ft. compounds of 1903 were probably the first 4-6-0 engines built expressly for this purpose, and for this class of traffic has been found in the 2-6-0, or "Mogul." This had been tried previously in England, but for the first time came prominently under notice in connection with the importation of American-built 2-6-0 tender engines in 1899 and 1900 by the Midland, Great Northern and Great Central Railways; the importations gave moderate satisfaction only, the American standard of construction at that time being lower than that which obtained here, and all have now been broken up. Mr. Johnson, the Midland Locomotive Superintendent at that time, reported in 1901 that the Midland "Moguls," while doing their work satisfactorily, cost 20 to 25 per cent. more

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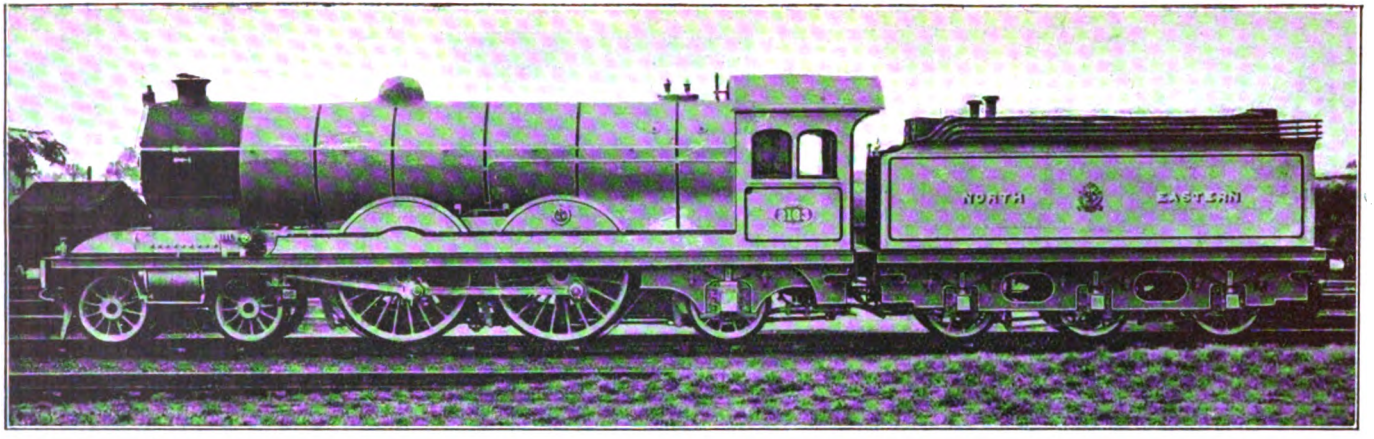
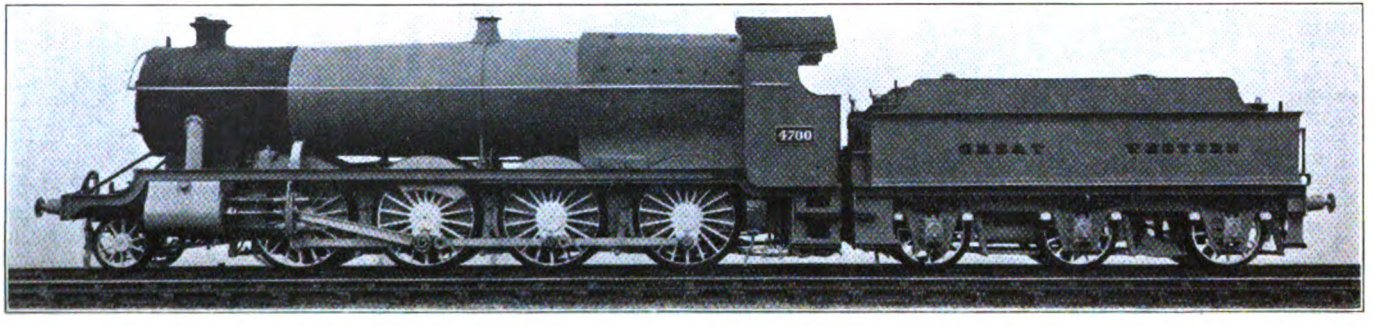


THREE-CYLINDER SUPERHEATER 4-4-2 ENGINE, NORTH EASTERN RAILWAY.
Sir Vincent Raven, K.B.E., Chief Mechanical Engineer.



2-8-0 MIXED TRAFFIC LOCOMOTIVE, No. 4700, GREAT WESTERN RAILWAY.
Mr. G. J. Churchward, C.B.E., late Chief Mechanical Engineer.

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in fuel consumption, 50 per cent. more in lubricants, and 60 per cent. more in repairs, than English engines performing the same duties. These engines were intended for ordinary goods service, as were also the first Great Western inside-cylinder "Moguls" in 1903; it was not until 1911 that the pioneer of the familiar Churchward outside cylinder 2-6-0's made its appearance on the Great Western Railway. At the end of 1912 an era of "Mogul"-building commenced with the appearance of Great Northern Railway No. 1630—Mr. Gresley's first design—at Doncaster, followed by similar engines on the Caledonian and London and Brighton and South Coast lines, and, in later years, on the Glasgow and South Western Railway and South Eastern and Chatham Railway.

Goods and mineral engine developments centre mainly round the introduction of eight-coupled tender engines on various railways. In 1897 0-8-0 locomotives were at work on the London and North Western Railway. Late in 1900 and early in 1901 there was a great outbreak of 0-8-0 engine building, the first examples then appearing on four different railways—Lancashire and Yorkshire, Great Northern, North Eastern and Caledonian—and on the Great Central Railway in 1902. The first British "Consolidation," or 2-8-0 engine, designed by Mr. Churchward, issued from Swindon works in 1903, and to the Great Western Railway and the same designer belong the distinction of introducing the first 5 ft. 8 in. mixed traffic engine of the same wheel arrangement—No. 4700—in 1919. "Consolidation" engines made their appearance on the Great Central Railway in 1911, and this particular design achieved special note in virtue of being chosen by the Army authorities as a standard in future construction for service on the Western front in the Great War. Many of these Robinson 2-8-0's were built in consequence, and after the war became distributed amongst almost all the leading British railways, during the continuance of the post-war locomotive shortage. The remaining 2-8-0 designs of note have been that of Mr. Gresley on the Great Northern Railway in 1913, and Sir Henry Fowler's Derby-built 2-8-0's for the Somerset and Dorset Joint Railway of the following year.

Of tank engine developments during the twenty-five years, the most notable was probably Mr. James Holden's 0-10-0 "Decapod" on the Great Eastern Railway in 1903. It was the first British 3-cylinder simple engine of any type; it possessed the first wide firebox seen in the British Isles, with by far the largest area of fire-grate —42 sq. ft.—ever tried here up to that time, and only since equalled in the Great Western and Great Northern "Pacific" designs; the 5 ft. 3 in. boiler, with its six safety-valves, was of a record size for the period; and the designed capacity of the engine—to attain a speeed of 30 m.p.h. in half-a-minute from the start with a 300-ton train—was on the trials more than realised. The locomotive thus proved the point desired—that it was possible with steam propulsion fully to realise the advantages then offered by electric traction—but was in advance of its time, and the expense of strengthening the underline bridgework sufficiently to carry so heavy an engine was not deemed justifiable; a number of parts were subsequently used in the construction of a 0-8-0 goods engine, which after a short life was scrapped.

Space would fail to deal with all the other notable tank engine designs of the period under review. The Great Northern Railway 0-8-2 tanks, first used in the London suburban services, the first Great Western Railway 2-6-2's, and Hoy's 2-6-2's on the Lancashire and Yorkshire Railway, were all outstanding designs of 1903; Caledonian 0-8-0 mineral tanks appeared in 1904, and the large Great Western Railway outside cylinder 2-6-2 and 4-4-2 tanks in 1905. "Precursor" 4-4-2 tanks commenced to run on the London and North Western Railway in 1906, and the first engines of the same wheel arrangement on the London, Brighton and South Coast Railway in the following year. The 0-8-4 Wath banking engines of the Great Central Railway were creations of 1908; the similar 0-8-2 engines on the Lancashire and Yorkshire Railway and 4-8-0 on the North Eastern Railway appeared in 1909, and the London and North Western Railway 0-8-2's in 1912. Meanwhile there had been a brisk outburst of 4-6-2 tank building, the London, Brighton and South Coast, London and North Western, Great Central and North Eastern Companies all turning out in 1910-11 large and powerful examples, in the first three cases superheated engines

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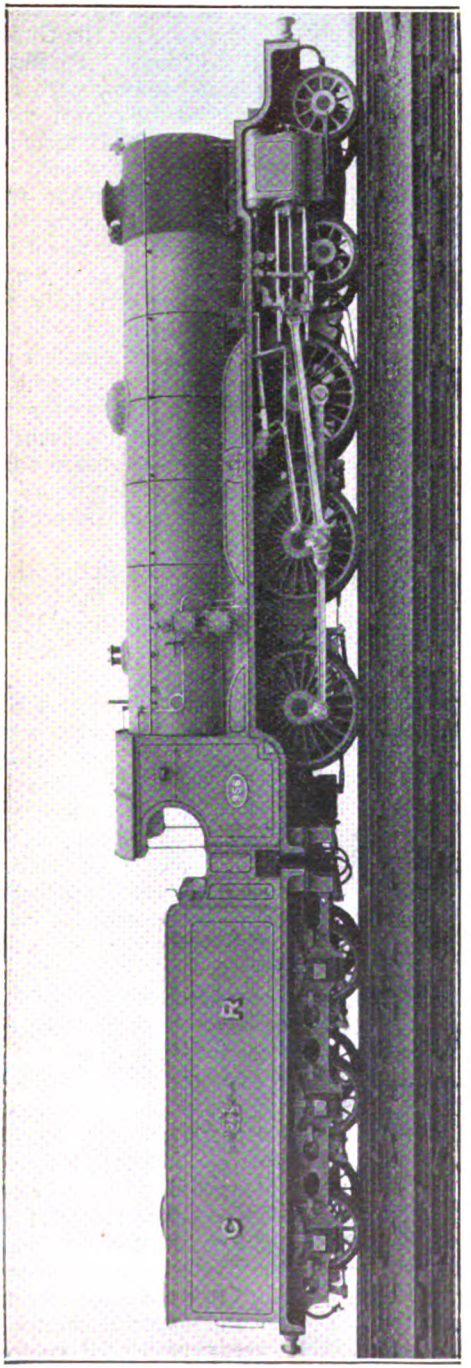
for passenger service; the next similar engines to be built were the Caledonian superheated 4-6-2's of 1917.

The 4-6-4 arrangement of wheels for express tank engines came into being on the London, Tilbury and Southend Railway in 1913, and was further developed on the Brighton in Mr. Billinton's magnificent 98-ton *Charles C. Macrae* of the following year; the same notation was adopted in striking designs by the Belfast and County Down Railway in 1920 and the Furness in 1921, and has now spread to Scotland, where Mr. Whitelegg's new 4-6-4's, on the Glasgow and South Western Railway, are already performing notable work on the expresses from Glasgow to Ayr and the Clyde Coast. Other outstanding types have been the Metropolitan and North Eastern 4-4-4's of 1913 and 1920; the Great Central Railway and South Eastern and Chatham Railway 2-6-4's of 1915 and 1917; and the London and South Western 4-8-0 and 4-6-2 designs by Mr. Urie of last year. It is probable that this development of the tank engine for fairly long distance main line work is also attributable in large measure to the successful working of the London, Brighton and South Coast 4-4-2 superheater express tanks from 1908 onwards. Between then and now Brighton main line work has come to be undertaken almost exclusively by tank engines, even to non-stop runs exceeding 80 miles in length, and the majority of the large and powerful tank types enumerated are similarly undertaking comparatively long distance running, for which tender engines were previously employed, thereby combining exceptional tractive power with the economy that comes of carrying coal and water supplies on the engine frames instead of in a separate tender.



THREE-CYLINDER 4-6-0 LOCOMOTIVE No. 956, CALEDONIAN RAILWAY.
Mr. W. Pickersgill, C.B.E., Chief Mechanical Engineer.

Of the most exceptional British designs from 1897 to 1922 the Great Eastern "Decapod" has already been described The Midland Lickey "banker"—No. 2290—with its four cylinders of 16¾ in. diam. and 28-in. stroke, affords the unprecedented tractive effort for this country, of 40,765 lb., or 18·2 tons, at 80 per cent. working pressure, and an adhesive power, with its 10-coupled wheels, of 14·8 tons without, and 19·9 tons with, sand—another record total. The two remaining British engines

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of altogether abnormal proportions have been Mr. Churchward's Great Western "Pacific" of 1908—*The Great Bear*—and now Mr. Gresley's Great Northern *magnum opus*, the 4-6-2 No. 1470, *Great Northern*, already referred to. Various difficulties have cropped up in connection with the running of the former engine, with the result that its working "zone" has been confined to the main line, between London and Bristol, and in view of the ease with which the Churchward 4-6-0's have since coped with the most difficult of Great Western Railway time-table demands, both in the realm of load and speed, No. 111 may be considered as somewhat before its time. But the long-promised Great Northern engine represents the fruit of much experience gained successively with the superheated "Atlantics," the "Moguls," and then the three-cylinder 2-6-0's of the "1000" class, and incorporates in its vast bulk the maximum express locomotive dimensions that this country is likely to witness. By the time these lines are in print Sir Vincent Raven's still heavier "Pacific" may also be at work on the North Eastern Railway.

Some of the most interesting locomotive events of the past quarter of a century have been the temporary exchanges of engines which have taken place from time to time between different railways. Express engines in the main have been the types exchanged, and Mr. C. J. Bowen Cooke, when commencing his locomotive superintendence over the London and North Western Railway in 1909, was the prime mover in most of these experiments. The first trial was that of the Great Northern "Atlantic," No. 1449, between Euston and Crewe for a month in that year, while at the same time the London and North Western 4-4-0 "Precursor" *Marquis* was worked between King's Cross and Leeds on important expresses. About the same date the Caledonian 4-6-0 *Cardean* was worked once or twice between Carlisle and Crewe, while an "Experiment" made some trips between Carlisle and Glasgow. Late in 1909 came the through running between Brighton and Rugby on alternate days of the Brighton superheated 4-4-2 tank, No. 23, and the London and North Western "Precursor" *Titan*, and in 1910 there took place the famous exchange of the Great Western Railway four-cylinder 4-6-0 *Polar Star* and the London and North Western "Experiment" *Worcestershire*, in which the latter, an altogether smaller and less powerful machine than her rival, did not show up well by comparison. The experience gained from the working of the Brighton tank resulted in the appearance of the "George the Fifth" class of superheated 4-4-0's in 1910, and the work of *Polar Star* was undoubtedly responsible for the production of the 4-6-0 "Claughtons" in 1913.

About the year 1911 large 4-4-0 engines were exchanged between the Great Northern and Great Southern and Western Railways of Ireland, and the Highland Company also exchanged a 4-6-0 "Castle" for one of the North British "Scott" class 4-4-0 engines. Recently the trials of a 2-8-0 Great Western mineral engine, and also one of the latest three-cylinder "T3" class North Eastern freight engines, on the North British Perth section last year, are fresh in mind, and the Lancashire and Yorkshire-London and North Western amalgamation was preceded by trials of a North Western "Prince" and a "Claughton" against one of the rebuilt and superheated four-cylinder 4-6-0's of Mr. Hughes design. Little in the way of comparative figures has ever been made public as a result of all these trials, with the exception of those which took place on the North British Railway last year; but it is beyond question that the conspicuous success of the earlier exchanges was achieved by the Great Western Railway 4-6-0 *Polar Star* and the London, Brighton and South Coast No. 23, while in the last-mentioned trials the superheated Hughes' 4-6-0's and the three-cylinder North Eastern Railway 0-8-0 have made the most noteworthy running. The forthcoming fusion of all the leading railways into four groups will, without doubt, lead to interchange of types on a scale never previously known, and in this connection the fact that three out of the four groups will each possess dynamometer cars of modern design should lead to the acquisition of valuable data as to the most efficient locomotive types in each group.

In regard to locomotive fuels, the year 1897 saw a number of express engines on

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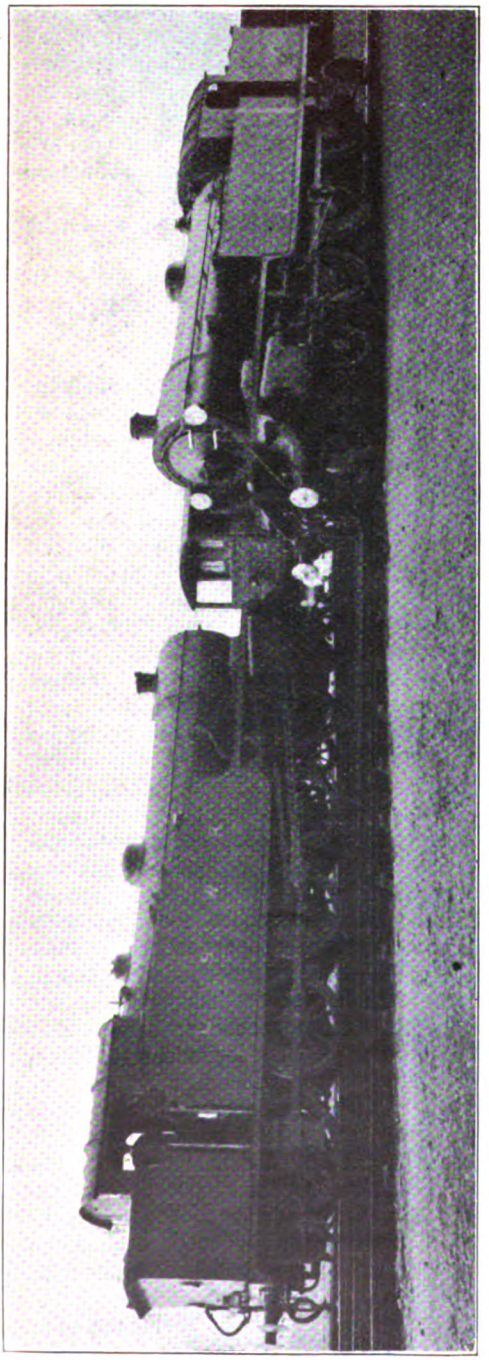
the Great Eastern Railway burning oil-fuel very successfully on the Holden system, and Mr. James Holden's "10" class 4-2-2 engines of 1898, and the "Claud Hamilton" 4-4-0 type of 1900, were designed as oil-burners. But the greatly increasing cost of oil in the early years of the present century gradually made oil as a fuel so much more expensive than coal that the practice had to be abandoned. The coal dispute of 1912 led to the equipment of one or two engines on the Midland, Caledonian and other lines for oil-firing, but did not occasion a reinstatement of the apparatus on the Great Eastern Railway, as that company alone had had the foresight to lay in a stock of coal sufficient to maintain full train services throughout the strike period. The coal strike of 1921, however, was a much more serious matter, and large numbers of engines, especially on the Great Eastern, Midland and Great Central lines, were fitted for oil firing until suitable coal was once more obtainable. A couple of years earlier Mr. Robinson, on the Great Central, had begun some important experiments in regard to the burning of pulverised and colloidal fuels on locomotives, but the practice has not passed beyond the experimental stage.



4-8-0 AND 4-6-2 TANK ENGINES, LONDON AND SOUTH WESTERN RAILWAY.
Mr. R. W. Urie, Chief Mechanical Engineer.

Many locomotive experiments carried out between 1897 and 1922, but not persisted in, might be mentioned. In connection with cylinders and motion, there have been the Dendy-Marshall system tried on the London and North Western Railway 4-6-0 *Prospero*, rebuilt with four cylinders in which the valves of adjacent cylinders are operated in pairs by single valve spindles; and also the "Uniflow," or Stumpf system on the North Eastern Railway 4-6-0 No. 825 and "Atlantic" No. 2212, whose cylinders exhaust in the centre instead of at the ends. Corrugated fireboxes were tried on the Lancashire and Yorkshire Railway by Mr. Hoy in 1902 on certain 0-8-0 coal engines, irreverently dubbed "Sea-pigs," but were not successful. Cross-water tubes in the firebox became a standard feature of the Drummond locomotive designs on the London and South Western Railway from 1898 onwards, but proved so costly in maintenance that they have all been removed by his

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successor. Various appliances have been tried for heating feed water, from the Druitt-Halpin thermal storage tank of 1904, mounted above the boilers of certain Lancashire and Yorkshire Railway 2-4-2 tank engines and Great Northern Railway 2-4-0's, and subsequently removed, to the successful systems in use to-day, such as the Drummond on the London and South Western Railway, and the Weir feed water heaters, of which many experimental installations are in use, though they have not become a standard equipment on any railway.

Superheating, of course, has definitely "come to stay," the original Swindon and Schmidt types of apparatus having now developed to many varieties in use on different railways, such as the Robinson, originating on the Great Central Railway, the Eastleigh, on the London and South Western Railway, the Horwich, on the Lancashire and Yorkshire Railway, and so on. The only unsuccessful type of superheater here has been the Phœnix, located in the smokebox; it was tried on the London, Brighton and South Coast, Hull and Barnsley, Furness, and Great Northern (Ireland) Railways, and subsequently removed from the engines so equipped. With superheating, various accessories have come into use, such as forced lubrication of the Wakefield, Intensifore, Detroit and other types, snifting valves, and other additions which together make the locomotive of 1922 a very different machine, both internally and externally, to that of 1897.

A movement commenced in 1904, and was led by the Great Western Railway, to operate branch lines by means of combined engines and coaches, or "rail motor cars," which could be operated from either end. During the next year it spread with great rapidity to practically all the leading British railways, but the disadvantages of this system of working soon became apparent. They were, principally, that the development of any defect in the engine put the whole equipment out of commission, and, further, that the small power of the engines fitted made the unit somewhat inflexible to deal with fluctuations of traffic. From this idea, therefore, developed the motor-train, or auto-train, wherein small engines, of types that in ordinary service are approaching supersession, are coupled permanently to one, two, three, four or even more coaches, either in the centre or at one end, the coach or coaches at the outward end of the train being provided with driving compartments from which the engine may be operated, while the fireman remains throughout on the footplate. These handy traffic units may now be seen on the majority of British railways, and few, if any, further rail motor cars of the original type have been built since the "boom" of 1905.

A few words, in conclusion, in regard to those who have held the chief locomotive administrative posts on the leading British railways from 1897 onwards will not be out of place. Mr. J. G. Robinson, of the Great Central Railway, takes the record of service with 22 years from the middle of 1900, when he succeeded Mr. H. Pollitt at Gorton. Mr. G. J. Churchward follows with 20 years at Swindon, from January, 1902, to December, 1922, during which the whole of the Great Western Railway locomotive stock has received the impress of his remarkable personality. Mr. J. F. McIntosh was at St. Rollox, Caledonian Railway, for 17 years from 1897 until succeeded by Mr. Pickersgill in 1914, and the London and South Western Railway also has only known two chiefs at Nine Elms, and subsequently at Eastleigh—Mr. Dugald Drummond from 1897 to 1912, and Mr. Urie from 1912 to the present day. Mr. R. W. Reid, succeeding Mr. Holmes at Cowlairs, North British Railway, in 1904, reigned for 16 years, until giving place to Mr. Chalmers in 1920; the period on the North Eastern Railway has been almost exactly halved by the succession of Sir Vincent Raven to Mr. Wilson Worsdell, in 1910, and at Doncaster, Great Northern Railway, Mr. H. A. Ivatt, up to 1911, and Mr. H. N. Gresley since, have divided the honours.

A number of lines have seen three changes; on the Midland at Derby, from Mr. S. W. Johnson to Mr. R. M. Deeley, in 1903; and again to Sir Henry Fowler in 1909; on the Great Eastern Railway at Stratford, from Mr. James Holden to his son, Mr. Stephen Holden, in 1908, and then to Mr. A. J. Hill, in 1912; Mr. Wainwright, taking over at Ashford from the South Eastern Railway, Mr. James Stirling, and the London, Chatham and Dover Rail-

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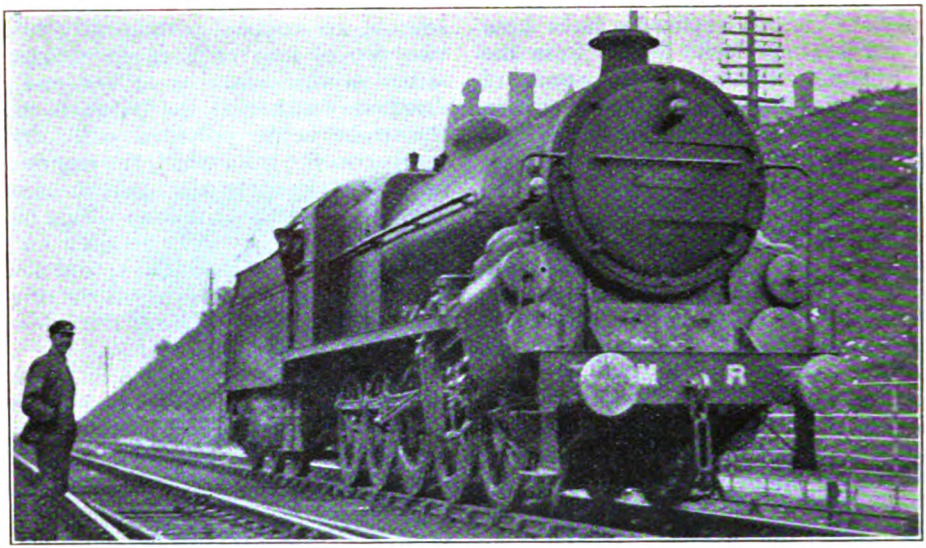
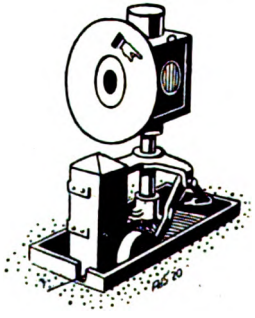


Photo.] MIDLAND RAILWAY. [*W. H. Whitworth.*

Four-cylinder 0-10-0 banking locomotive, No. 2290.
Sir Henry Fowler, K.B.E., Chief Mechanical Engineer.

way, Mr. Kirtley, on the formation of the South Eastern and Chatham Railway in 1899, yielded the reins to Mr. Maunsell in 1913; and two Billinton *régimes* on the London, Brighton and South Coast Railway—the present one from 1911 and the previous one up to 1904—enclose Mr. Earle Marsh's period of superintendence at Brighton. The London and North Western Railway has had the most variegated locomotive history of any : Mr. F. W. Webb relinquished the chief executive position in 1906, and was followed by Mr. G. Whale, who completely reversed the previous compound policy, to the great advantage of the railway in question; then came Mr. Bowen Cooke in 1909, who was responsible for the wide introduction of superheating; Mr. Hewitt Beames followed in 1920, but in the present year became a divisional officer to Mr. G. Hughes at Horwich, on the amalgamation of the Lancashire and Yorkshire and London and North Western Railways.

It is not, perhaps, inappropriate to conclude with the observation that, in this 300th issue of the RAILWAY MAGAZINE, "British Locomotive Practice and Performance" registers its 250th appearance.



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Random Railway Recollections.

By W. J. SCOTT, B.A., &c.

A LIFE of seventy years—*Dies annorum nostrorum septuaginta anni*, says the psalmist—means memories of many things; when much of the conscious part of that life has been given to a keen study of railway matters it must mean many recollections of railway happenings. So, at the bidding of the Editor of the RAILWAY MAGAZINE I endeavour to put some of these recollections on to paper, also trying to keep clear of what might easily become "The Diary of a Nobody"; what F. P. Cockshott or Sir George Gibb have said may well be of interest to many readers, what *I* said to them is of great interest (no doubt) to myself—and to no one else.

As one of my earliest memories is of a journey by rail to Brighton and the taste of a currant bun eaten on the way lingers yet, so I am driven to the conclusion that from the age of seven years (which brings me to the year 1859), if not earlier, I took an intelligent interest in railway matters. As I cannot recall the learning to read (no doubt I had to learn as other children do), so I cannot call to mind when and how I first learnt to "read" a time-table. Let it not be thought that every one can, or does, possess the power of doing so; to readers of this MAGAZINE those weird columns of Arabic figures (with the ancient Roman numerals no "time-tables" were practicable), which in "Bradshaws'" or "Working Books" are so familiar that they may forget that there are some—"many such there be"—who are unable to read them intelligently. Of this I have lately had two weird instances: one dating from 1845, one quite recent. The former instance is the case of a "Devonport" journal—long since defunct—which gave in July, 1845, a most wild "table" of (supposed) trains between Paddington and Exeter. A glance at the true table for the same date shows in a moment that the "bars" beneath a train's terminal station meant nothing to the able editor; any local trains printed in the same columns were taken to be part of the times of the original train; thus a "local" from Exeter to

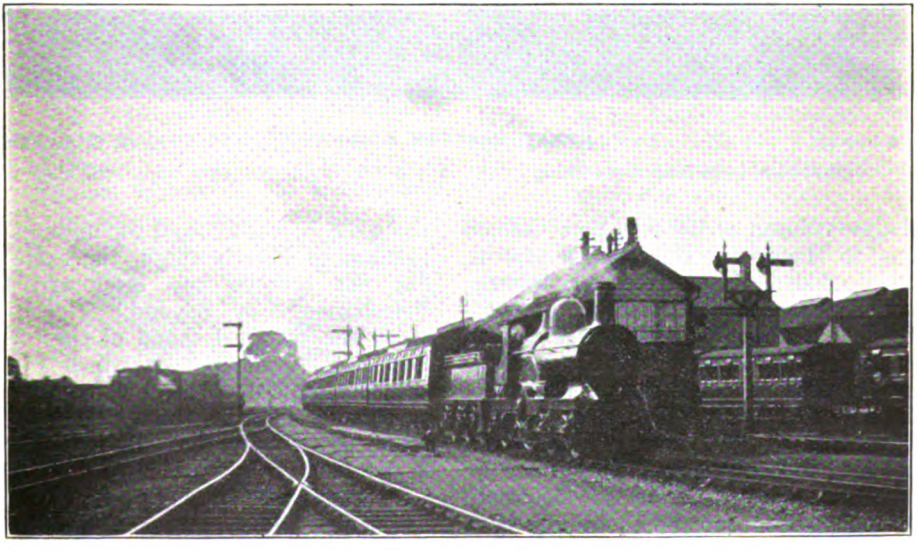

Photo.] GREAT WESTERN RAILWAY. [*Capt. F. S. Watson.*

Up Cornish Express passing Taunton. Modern stock, but worked by old 4-2-2 engine "Stormy Petrel."

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Wellington is given as though it reached Bath, running non-stop Wellington to Bristol; while a down train, really a "local" Paddington to "Maidenhead," is shown as making a direct run non-stop, to Exeter, in the astounding time from Paddington of—6 hours 50 minutes!

The other instance dates only from last summer, when (the former 6.15 p.m. from Cannon Street to Ramsgate being altered to 6.10) a quite imaginary train at 6.16 from Cannon Street was shown in the (newspaper's) time-table; the reason for this was apparent when the "broadsides" were looked at, for in them the stopping train, 7.30 p.m. from Faversham, which followed the express thence appears in the same column as the 6.16 p.m. Cannon Street to Hastings. But though absurd, this train, like the White Knight's pudding, was "a very clever train to invent." For if any railfaring man were foolish enough to trust the local table and to come to Cannon Street for a Ramsgate train at 6.16 he would find a train going out exactly at that hour which would whirl him to Tunbridge Wells, where he would arrive too late to get back to Ramsgate or Margate at all till the next day. (It may not be amiss to remark that even working time-books—as now printed—on the Underground system, need something rather like a table of logarithms for their interpretation, *e.g.*, would anyone undertake to say off-hand at what time the 9.3 a.m. from Ealing Broadway arrives at Gloucester Road?)

It was in the year 1872 that (greatly daring) I made up my mind to write to F. P. Cockshott, suggesting that the 9.0 a.m. fast from King's Cross (the present 8.45 a.m.) might call at Hitchin, and so pick up passengers for the North from the 8.30 a.m. from Cambridge. Rather to my surprise I had an answer, almost by return of post, from the great man, saying that my suggestion was a good one, and I should find it adopted in the next month's time-tables; which I did. (As the 9.0 a.m. was allowed 100 minutes from London to Peterborough, the extra stop did not involve any later arrival at Peterborough or beyond.) I can still recall the stamped shield of the "Union Society's" notepaper on which I wrote, and the quill-pen—all the writing-room pens were quills in those days—which I used; when I saw the "stop" at Hitchin in the June or July tables—I forget which—for that year, in the words of Horace, I "struck the stars with my sublime vertex" (what a "sublime vertex" is I am not quite sure); but anyhow I walked about with my head in air for some time

Photo.] GREAT EASTERN RAILWAY. [*K. A. C. R. Nunn.*

Hunstanton–Lynn train approaching Lynn. 2-4-0 7-ft. engine No. 1019 before rebuilding.

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afterwards. In writing I used the name of G. N. Tyrrell, whom I had the happiness of meeting some six years earlier, as a kind of introduction. To the latter —then, and for many years after, the Superintendent of the Line on the Great Western Railway—I owed my first admission to official railway circles in general, and those of his own line, the Great Western, in particular. When some 15 years later the world-famed "Race to Edinburgh" of 1888 befell, I presented myself at King's Cross and boldly asked to see Mr. Cockshott. I did succeed in seeing his then assistant, Mr. Alexander (who afterwards filled his post), and from him had much kindness. I went down that morning to York by the "racing" part of the 10.0 a.m. with a load of well under 100 tons (six six-wheel coaches) behind the tender. This as it happened, was the last day (August 31) of the great race; those who care to do so may turn to No. 1 of this MAGAZINE—the July, 1897, No.—for an account of the run. The load was not a specially light one for those days, in fact, until about 1895 *all* coaches were six-wheeled ones (unless they had but four wheels), while trains of 10 such coaches—possible weight about 130 tons—were looked on as long and heavy.

This great change, from six-wheel to eight-wheel vehicles, and from trains of 80 to 150 tons to those of at least 300 (sometimes 400) tons, by far the greatest one that has befallen British railways in the 70 years between 1850 and the present day, may seem almost unbelievable to those whose railway experiences are those only of the 20th century. To them every long-distance express is, to a certainty, made up of eight-wheeled corridor stock, usually "vestibuled" together—yet in 1897 I could truthfully write "Six-wheeled vehicles, rigid axles and 'stuffy lonesome compartments' without lavatories or warming apparatus, are still the standard on many English lines."* And, again (in the same number of the MAGAZINE): "The Great Western . . . [put on] a train of corridor stock throughout with side gangway connections . . . from end to end [but] as the doors between each vehicle were carefully locked and the paths of glory led but to the brake-van (with no refreshments on the way), not much was gained practically." In truth, the "corridor" train of eight-wheeled stock is almost a growth of the present century, though there were beginnings of it in the last 10 years of the 1800's; a small band of energetic "amateurs," of whom Rous-Marten, Norman D. Macdonald and W. M. (now Sir William) Acworth were the best-known, worked hard to bring about this reform.

The man they specially converted and convinced on this head was Sir George Gibb, who (somewhat to the surprise of official circles) became General Manager of the North Eastern Railway about 1891, and at once began some energetic reforms. His endeavour to "Americanize" the North Eastern organisation was not wholly successful, and has only partly lasted to this day. His appointment of P. Burtt as Superintendent of the Line proved a good stroke, but the (nominal) raising of the latter to the indefinite office of "Chief Traffic Manager," did not answer so well; the latter able and pleasant man had—for reasons the writer never could understand—a far from happy railway career, and ultimately resigned (when Passenger Manager), and retired into private life to the great regret of his friends, among whom the writer reckons himself as one.

When Sir George Gibb came to London as head of the Electric Underground combination, he was hailed as the "straphanger's friend" by the London newspapers, but his position under the sway of a financial firm (Yerkes & Co.) was not a wholly satisfactory one. But he did unearth a very able subordinate, W. E. Blake, who as Superintendent of the Line, first of the District Railway and then of that line with all the "Tubes" in the Underground group, did admirable service to his railways and to the general public; though a youngish and seemingly healthy man, his career was cut short by an accidental hurt which turned to blood-poisoning; his place has been taken by his former chief inspector, Mr. J. Thornton, who ably carries out his former chief's "non-stop" policy. It was during Mr. Blake's time of office that the lines quoted on the following page became true:

* RAILWAY MAGAZINE, 1897.

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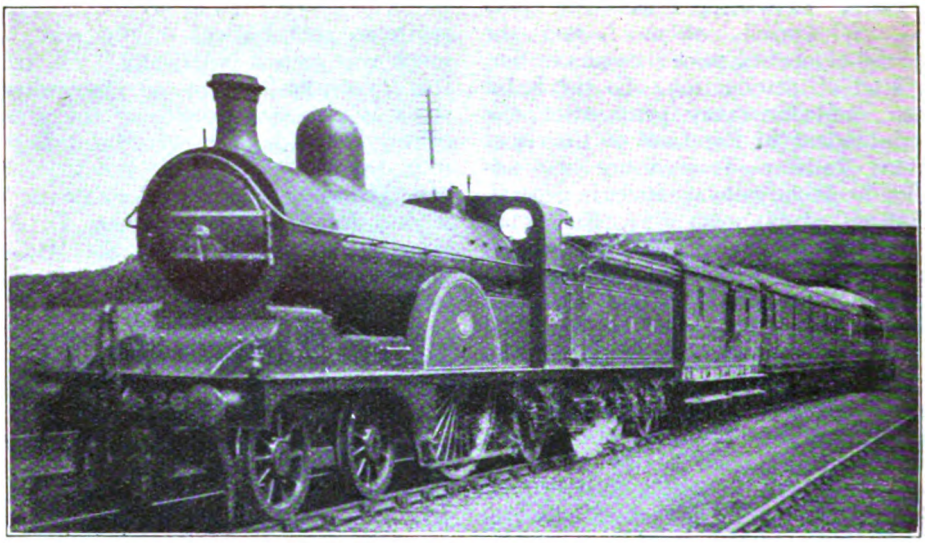

Photo.] GREAT NORTHERN RAILWAY. [*R. Hall.*

Ivatt 4–2–2 engine, No. 269, on down express.

" In 1900 we'd enough
Of smoky trains that went puff-puff.
Now we have perfection found ;
The bright Electric Underground "

But my pen—like Mr. Brookes's, of Tipton, " a thinking organ "—has run on into modern days ; to turn back for a moment, to those two contrasted figures, G. N. Tyrrell and F. P. Cockshott ; like in their thorough grip of all practical details of railway working, but how unlike as to policy ! The former was always opposed to high speeds—he was doubtless quite happy through that dismal year of 1868, when the " Flying Dutchman " did not run—and to any increase in train-mileage. It used to be said that the late J. Grierson (himself not over-progressive) did sometimes urge as a matter of " policy " that some additional trains should be run on the Great Western Railway ; but that the then Chairman (Sir D. Gooch), on finding that these proposals were not favoured by Tyrrell, at once vetoed them. What the Great Northern was under Cockshott's superintendence, it is needless to say. " It were waste of time to praise this small line " as—I quote from memory—Foxwell expresses it ; or, as a Great Western officer once said to me " Cockshott has given his line a service of express trains which is a model to the world." When J. Alexander succeeded him, all this was well-maintained ; alas, that the Great Northern, once the leading light in European train-speeds, should to-day rank so far down the list as to fast running ! Ah, well ! railways have their fates (like books) one supposes : and as the Great War stopped those wonderful runs of the *Nord* (of France) between Paris and St. Quentin, the (British) Great Western to-day holds pride of place, over a wonderfully easy road it is true, but with a far from light train. Gone, alas ! is that much more difficult run (except as to load) on the Caledonian from Perth to Forfar, 32½ miles, some of them sharply up-hill, in 32 minutes, start to stop. So it was decreed in the Caledonian time-books for 1896, and this by the Traffic Department authorities, without any consultation beforehand with the locomotive people. J. F. McIntosh and his wonderful engines could be trusted to do anything that might be asked of them. I well remember finding this remarkable booking in the proof table, and old " J. F.'s " exclamation " Och ay ! juist like that beggar Kempt. Ay weel, we'll have to do it, somehow." [Though Highland by blood, Mr. McIntosh's speech was Lowland.] And done it was, with something to spare, as the writer—who " clocked " this run from the footplate once—can bear witness.

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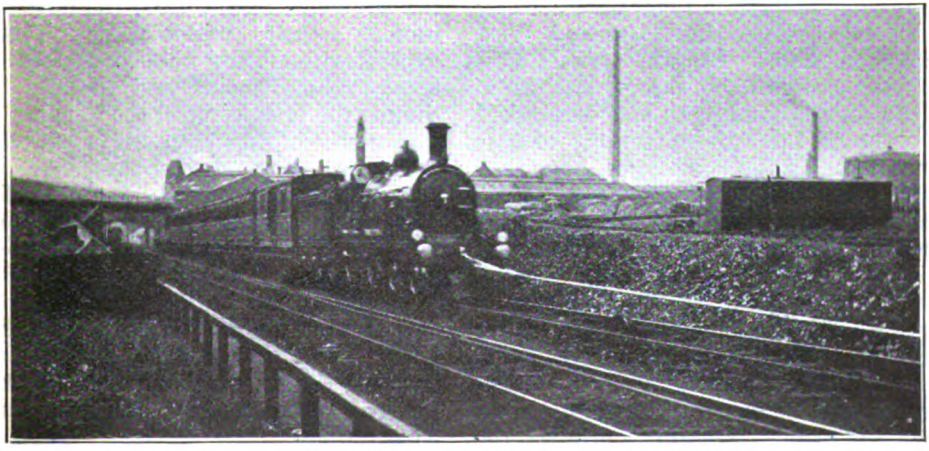
Both are now "in the land o' the leal"; Irvine Kempt (who dressed like a "buck" of the Regency days, with gills to his shirt and a ribbon from which dangled gold seals), and the one-armed J. F. McIntosh. I can still (in fancy) hear the latter say, as I suggested arm-rests in some third-class coaches then building at St. Rollox, "Come oot; ye want too much."

But my earliest memories of railway matters go back to before 1860: notably of a journey from King's Cross to York (on the way to Scarborough) by the then 9.30 (or possibly 9.15) a.m.—now 10 a.m.—train. I remember my surprise at finding the coach I was in was a *North Eastern* Company's vehicle (the days of East Coast Joint Stock were not yet)—like most folk born and brought up in the South, the "North Eastern Railway" was quite unknown to me then. I believe that vehicle went through to Edinburgh (due there about 8.20 p.m.), though the train would be in North British hands from Berwick onwards. We ran into the *old* station at York; when some 50 years later I again stood in that building (now in use as a carriage shed) I was surprised to see how relatively small it was: to my youthful eyes the terminus had bulked quite big. About a year afterwards—it cannot have been later than 1859, as there was no railway open to Malvern—I travelled over the Oxford, Worcester and Wolverhampton Railway from Oxford to Worcester, and can well remember the rusty broad-gauge rails on that system; laid, so far as my memory goes, on one road only. Indeed, I believe there was some preposterous suggestion that B. G. trains (probably to be supplied by the G. W. Co.) should be worked on a single line, while the owning Company continued to run down and up trains (N.G.) on their separate tracks. Needless to say, the Board of Trade would not sanction this queer proposal; (so at least it was reported). The words "Handboro' *Junction*" on the name board of that station astonished me not a little, occurring at a place miles from any physical junction; that it was the exchange point with the London and North Western Railway trains I had then no idea; nor, unluckily, did I take note of the train from Euston which joined us (or which we joined) at Handboro'. What I do call to mind is the fact that the O. W. and W. Co.'s coaching stock was not in the best condition; for, truth to tell, the roof of the compartment—a first-class one—leaked perceptibly.

But if unchecked by the editorial blue pencil, these memories might well (to quote Calverly's perfect parody of "The Ring and the Book") "extend from here to Mesopotamy," and so I must bring these "Random Railway Recollections" to a close.

CABLE-ASSISTED TRAIN ON THE NORTH BRITISH RAILWAY.



PASSENGER TRAIN ASCENDING COWLAIRS INCLINE, GLASGOW, ASSISTED BY HAULING ROPE. THIS PRACTICE WAS DISCONTINUED IN 1908. TRAINS ARE NOW "BANKED" AS REQUIRED.

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Photo.] LONDON, BRIGHTON & SOUTH COAST RAILWAY. [*G. E. Ellis.*

Up "Southern Belle" Express in early days.
Worked by 4-4-0 locomotive "Princess Royal," and carrying old head code.

British Passenger Train Services —1897-1922.

BY "VOYAGEUR."

IT was with British railway speeds on the decline that the period of our consideration opens. The famous "Race to Aberdeen" of 1895 had left a legacy in 1896 of very much faster scheduled speeds between England and Scotland than had obtained previously, even though minimum times were fixed by agreement between the East and West Coast Companies. But the serious accident to a Scotch night express at Preston in July of the same year had so shocked public opinion that by the summer of 1897 a considerable falling-off in speed had taken place, practically restoring the *status quo ante*, and Anglo-Scottish times had settled down into an undistinguished groove in which they have remained ever since. There were the makings of a fresh race in 1901, when the Midland and North British Companies accelerated their 9.30 a.m. express from St Pancras to reach Edinburgh at 6.5 p.m.; the East and West Coast Companies promptly curtailed the running times of their morning trains from London to the Scottish capital to 8¼ hours, and the London and North Western and Caledonian Railways distinguished themselves by running the 10 a.m. from Euston into Edinburgh at 5.40 p.m. on July 1st, but the contest was over almost as soon as it began. Further, in the summer of 1908 the Midland Railway tried the novelty of running their mid-morning Glasgow express without any publicly-booked stop between St. Pancras and Carlisle, continuing the practice until the war, but this was more in the nature of a travelling attraction than a speed exploit. And now again there are strong rumours of a fight between the Eastern and Western groups for the Scottish traffic; the new Great Northern and North Eastern "Pacifics" are said to have been designed expressly with a view to making Edinburgh from King's Cross with one intermediate stop only—at York, which should lead to a thrilling response from the other side. *Nous verrons.*

So it was that, in July, 1897, as compared

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with the corresponding month of 1896, the best booked speed on the London and North Western Railway had dropped by some 3 m.p.h. to 53·3; and on the Caledonian—the premier line for speed at that time—such a magnificent timing as 125 min. for the 117¾ miles from Carlisle to Stirling, by the night express to the Highlands, had expanded by 20 min. On the London and North Western Railway proper, Manchester was still 4¼ hours distant from London, even though the Manchester, Sheffield and Lincolnshire and Great Northern Railways, over a route 16 miles further, and very far more difficult in grading—it included the Manchester-Woodhead-Sheffield section whose profile appeared in the last issue—were actually maintaining the same times. Liverpool was at the same distance from Euston in point of time. The Midland Company were running from St. Pancras to Manchester in 4¼ hours in 1896, but by 1897 the best time had increased by 5 min. Elsewhere there had been little or no increase in booked speeds for decades, and even such a line as the Great Western was as far removed in speed from the Great Western Railway of to-day as could readily be imagined. The table reproduced herewith gives a good general idea of the speeds obtaining in July, 1897, between London and the chief provincial cities and towns; in compiling the 1897 figures I am indebted to Messrs. Henry Blacklock and Company, Limited, the printers and publishers of "Bradshaw's Guide," for their courtesy in loaning me a complete file of that publication from July to December, 1897. In the table there will also be seen, compared with the 1897 times, those in force in July, 1914, immediately before the war, those of the worst war period—October, 1918—and those now operating; while the last columns show the fastest times that have been scheduled in any year of the intervening period, together with the respective percentages by which the best present times fall short of these minimum figures.

During the twenty-five years from 1897 to 1922 the chief alterations to train services and their causes, may be summarised as follows:—

(1) Opening of the Great Central Railway Extension to London, 1899.

In 1897 the Manchester, Sheffield and Lincolnshire Railway—a line running from Manchester in the west to Grimsby in the east, with a southward extension from Sheffield to Annesley, north of Notting-

Photo.] MIDLAND (LONDON, TILBURY & SOUTHEND) RAILWAY. [*F. E. Mackay.*

Chalk Farm–Southend Through Train. Small 4-4-2 tank engine, No. 31, "St. Pancras," as running before the London, Tilbury and Southend Railway was taken over by the Midland Company.

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ham—assumed the title "Great Central Railway," preparatory to opening a long-promised and violently-opposed extension to Marylebone, London, on March 15th, 1899. In the early years of opening, while the track was consolidating, no extreme speeds were attempted, but by the years 1903–1905 some very fast train services had developed from London, serving Leicester, Nottingham, Sheffield, Leeds, Halifax, Huddersfield, Bradford and Manchester. At the zenith of Great Central speed history Leicester (103 m.) was brought within 1¾ hours of London; Nottingham (126½ miles) within 2 hours 13 min.; Sheffield made by the London and North Western and Midland lines of their London-Manchester services finally brought those two lines into competition with each other, a competition which was intensified by the fact that in 1902 the Midland had opened their new direct line from New Mills to Heaton Mersey (Cheadle Heath), avoiding Stockport (with some slow travelling over junctions in the vicinity of that town) and saving 1¼ miles. In 1902 the best London-Manchester times had come down from 4¼ to 3¾ hours, and in May, 1904, the highest point of this competition in speed was reached when the London and North

Photo.] GREAT WESTERN RAILWAY. [*F. E. Mackay.*

Down Birmingham Express. Two-cylinder 4-6-0 locomotive No., 2939 "Croome Court."

(164¾ miles) 2 hours 50 min.; Huddersfield within 3¾ hours; Bradford, 4½ hours; and Manchester 3 hours 50 min. This necessitated corresponding replies on the part of competing companies; the Great Northern Railway cut their fastest Leeds-London time to 3 hours 35 min. in the summer of 1901, and further, by omitting the Grantham stop and running without a halt over the 175¾ miles from Wakefield to King's Cross, to 3½ hours in 1903; in July, 1905, non-stop trains were instituted also between King's Cross and Sheffield, 161½ miles in 170 min.

These developments brought other companies into the fray, and the accelerations Western Railway reduced their Euston-London Road "crack" time to 3½ hours, and the Midland replied with 3 hours 35 min., from St. Pancras to Central. It was not long before the Great Central management found that their lightning times were not proving remunerative, and began, by easing of speeds and additional stops, to adjust them to the figures with which we are familiar to-day; but I think there can be little doubt that much of the improvement in the train services between London and the important centres of population in Lancashire and Yorkshire in the early years of the present century may be traced in their origin

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to the enterprise of the new "competitor."

(2) THE AWAKENING OF THE GREAT WESTERN RAILWAY.

The history of the development of Great Western main line train services from 1900 onwards is without parallel on any other British railway, because to a great extent it bespeaks unlimited enterprise without the spur of effective competition. A definite policy was conceived by the Great Western Railway management about the beginning of the century of bringing the West of England nearer both London and the Midlands by means of "cut-off" lines, shortening the somewhat circuitous Great Western main line mileage of that period—the "Great Way Round," as it was sometimes irreverently called—and, later, of building in a systematic way locomotives capable of accelerating materially the running speeds then current. If this policy was pursued regardless of cost, it is impossible to deny that it has borne abundant fruit. The sequence in the opening of these cut-off lines has been as follows:—

GREAT WESTERN RAILWAY "CUT-OFF" LINES, 1901–1922.

No.	Section.	Length.	Shortening distance from London. To	Shortening distance from London. By	Opened.
		Miles.		Miles.	
1	Patney to Westbury ..	15½	Westbury and beyond ..	(a) 5½ / (b) 14¼	1901
2	Wootton Bassett to Patchway	30¼	All parts of S. Wales ..	12	1903
3	Old Oak to Ashendon Jc.	41	High Wycombe and beyond	7½	1905
4	Castle Cary to Cogload ..	22½	Taunton and beyond ..	20	1906
5	Tyseley to Cheltenham ..	50½	(Birmingham & North) to Bristol and beyond ..	(c) 32¾ / (d) 42½	1908
6	Ashendon Jc. to Aynho Jc.	18¼	Banbury and beyond ..	18½	1910
7	Swansea avoiding lines ..	—	Carmarthen and beyond ..	—	(e)

(a) Via Newbury and Devizes (largely single line).
(b) Via Chippenham. (c) Via Worcester, Hereford and Severn Tunnel.
(d) Via Oxford, Didcot Curve and Swindon. (e) Not yet complete.

Now the companies to be affected by the substantial cutting of journey times which were bound to follow the completion of these extensive works had already begun to "nurse" the districts concerned in the way of accelerated times. The Great Western Railway had commenced running non-stop trains over the 194 miles between Paddington and Exeter, *via* Bristol, in July, 1897, covering the distance in 3 hours 43 min.; in 1901, the London and South Western authorities cut their Exeter time to 3½ hours, and in 1903 to 3¼ hours, continuing to Plymouth (Devonport) in 4¾ hours from Waterloo. In reply to this, the Great Western Railway had not been able to get below 3 hours 25 min. to Exeter in 1905, but the institution of the "Cornish Riviera" express in the summer of that year, making a daily world's record run of 245¾ miles without intermediate stoppage, brought the Plymouth time down to 4 hours 25 min. And then the opening of the Westbury route in 1906 changed everything. Exeter was brought within 3 hours of London, Plymouth within 4 hours 7 min., and, ultimately, Penzance within 6½ hours—gains in the last two cases of one and two *hours* respectively over the times obtaining in 1897, or very far more than could be expected to arise out of mere competitive conditions. So much did this opening affect the London and South Western Railway traffic that of recent years that company has ceased to attempt an effective through service between Waterloo and Plymouth.

Meanwhile other West of England services were being developed with equal vigour, and in August, 1903, the timing over the 117½ miles from Bristol to Paddington over the newly-opened Badminton route had been reduced to the even two hours, a down 2-hour run *via* Bath following in 1904. As the Great Western Railway services to the North

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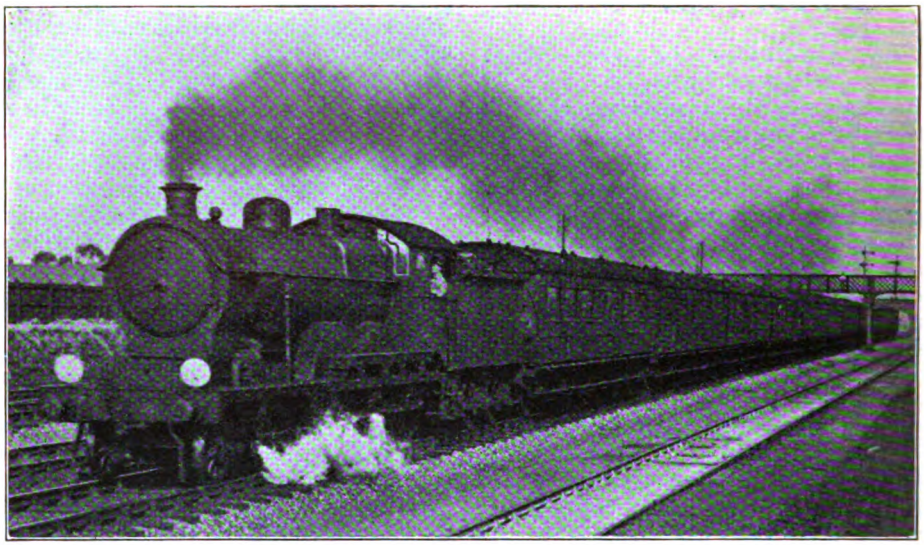

Photo.] GREAT EASTERN RAILWAY. [*F. E. Mackay.*

Up Yarmouth Restaurant Car Express. 4-6-0 engine, No. 1515.

began to improve, in anticipation of the opening of the Bicester route, the London and North Western authorities, copying the example of the London and South Western Railway, began to turn their attention to Birmingham. As far back as 1898, the Great Western Railway had commenced running non-stop trains between Paddington and Birmingham, on a schedule of 147 min. for the 129¼ miles, and this dropped gradually to a minimum of 137 min. in 1904; but meanwhile the London and North Western Railway had reduced their non-stop Euston-Birmingham schedule for the first time to 2 hours in 1902, and were running a full 2-hour service by 1905. Shortly before the opening of the Great Western Bicester "cut-off," in July, 1910, the London and North Western Railway instituted, in February, the "City to City" express, between Wolverhampton, Birmingham and Broad Street, London, in each direction, with a novelty in the way of typewriting compartments on the trains, which afterwards spread to certain of the Euston trains also.

But the inauguration of the Great Western route did not eventually lead to cut-throat time-cutting, as the 2-hour timing was agreed on by the two companies as a standard, and has remained so since, except for the war period. The Midland Company also prepared in advance for the Great Western Railway Birmingham-Cheltenham-Bristol opening by a considerable acceleration of their West of England services, including the running of non-stop trains between Bristol and Birmingham in 1905, the fastest time for the 88¾ miles being 110 min., but the last-mentioned schedule was not long-lived, as it was found that the Great Western Railway Bristol-Birmingham journey could not be completed in so short a time as had been anticipated. Thus, the awakening of the Great Western Railway has played an important part in the development of British speed between the years 1900 and 1910, to say nothing of its post-war revival. As regards the towns on the Great Western system which figure in the table, indeed, the times between them and London to-day average all but 20 per cent. less than those of 1897, which could be said of no other British system; the Anglo-Scottish services of June, 1927, for example, are considerably worse than those which obtained in July, 1897, in point of time, and worse still than those of 1896.

(3) Competition between London and West Riding Towns in Yorkshire.

Reference has already been made to the influence of the opening of the Great

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Central extension to London, and subsequent accelerations, on this West Riding competition. The completion in 1909 of the first portion of the contemplated Midland direct line from Royston to Bradford—as far as Thornhill, where connection was made with the Lancashire and Yorkshire main line—offered a new route to the West Riding, which was at once made use of, with through carriages between St. Pancras and Halifax, Huddersfield and Bradford. In the summer of 1910 the Midland carried the contest to the length of dividing the 1.30 p.m. down "Scotsman," and running the second part as a "Yorkshire Corridor Express" to Sheffield and Bradford direct, reaching the latter city in 4¼ hours. This stung the Great Northern Railway into the retort of their famous 2.15 p.m. down Bradford express, put on at less than a week's notice on July 11th, and reaching Bradford in 3 hours 40 min. from King's Cross; there was also a corresponding up express in the evening. Further, while the Midland had been running the 10.30 a.m. from Edinburgh to London non-stop from Leeds during the summer months since 1904, at first in 3¾ hours, then in 1906 in 3 hours 33 min., and latterly on a slightly easier schedule, in 1910 the 1 p.m. up from Leeds in addition was altered to run non-stop from Rotherham, and reach St. Pancras at 4.45 p.m. This the Great Northern Railway countered by bringing their 2 p.m. from Leeds into King's Cross at 5.25 p.m.; the last-mentioned acceleration survived till the war, but the Bradford "specials" vanished during the Coal Strike period of 1912. The latest West Riding competition has been inaugurated by the London and North Western Railway, since the absorption of the Lancashire and Yorkshire Railway in the present year, by running through expresses, including a dining-car train, between Euston, Huddersfield and Halifax.

(4) Miscellaneous Improvements to Express Services.

A notable encouragement to summer coast traffic was given by the Great Eastern Railway as far back as July, 1897, in instituting the "Cromer Express," with a non-stop run over the 130 miles between Liverpool Street and North Walsham, and this was followed by the accelerations of 1904, when Yarmouth and Lowestoft were for the first time brought within 2½ hours of London by non-stop services. The London and South Western Railway followed the Great Eastern lead by inaugurating Waterloo and Bournemouth "non-stops" in 1899, taking 125 min. in each direction, which timing, after sundry subsequent vicissitudes,

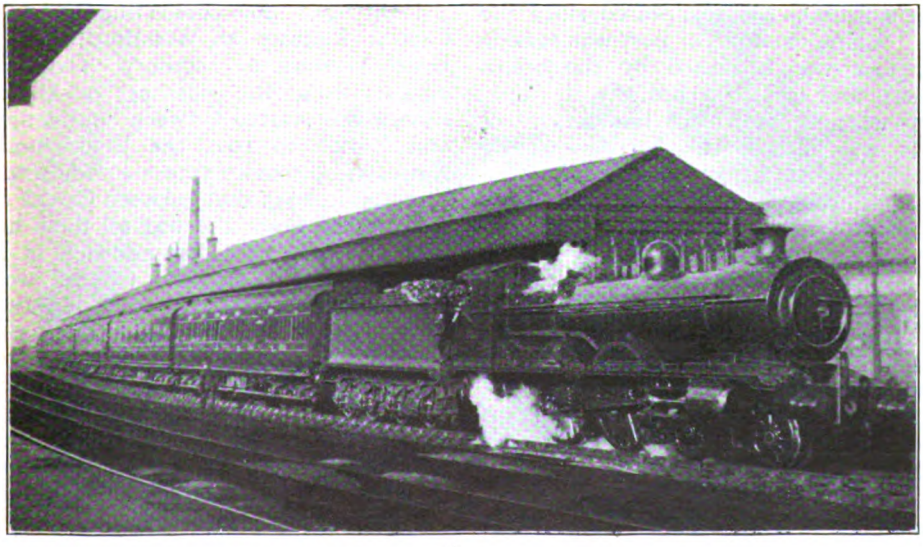

Photo.] **GLASGOW & SOUTH WESTERN RAILWAY.** [*W. A. Millar.*

South Express at Kilmarnock. Rebuilt 4-6-0 locomotive, No. 506.

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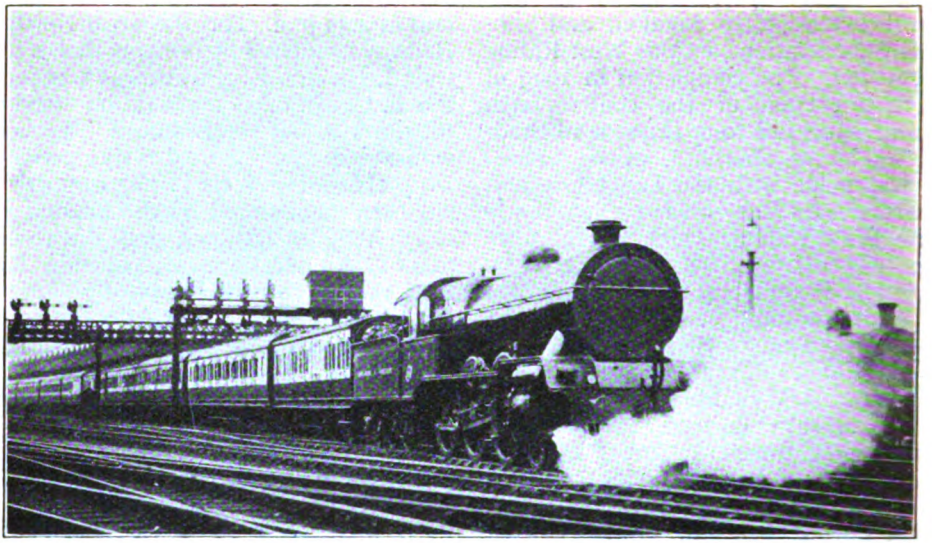

Photo.] LONDON & NORTH WESTERN RAILWAY. [*W. H. Whitworth.*

Mr. G. Hughes' rebuilt superheater 4-6-0 locomotive No. 1519 leaving Crewe.

dropped to the even two hours in 1911. On the London, Brighton and South Coast Railway the 60-min. booking between Victoria and Brighton, instituted by the Sunday "Pullman Limited" in 1898, became a daily schedule on the introduction of the *Southern Belle* express in 1908, which at the same time struck a new note in luxurious travel in this country. Of these trains, the *Southern Belle* alone (with other expresses now running on the same schedule) has reappeared since the war. A fine example of post-war seaside enterprise was furnished by the South Eastern and Chatham Railway in June, 1919, when a new main line service of trains was introduced superior to any previously operating. Since then the London-Folkestone express time has been reduced to 85 min., and a further reduction to 80 min. is now foreshadowed.

The year 1902 saw the commencement of two important high-speed schedules in England, the North Eastern Railway running a train from Darlington to York, 44·1 miles, in 43 min. start-to-stop—proudly advertised as the "Fastest Train in the British Empire"—while the Lancashire and Yorkshire Railway started a service of 40-min. expresses over their exceedingly difficult 36·6 miles' route between the two cities. Both bookings vanished during the war, the latter time being now uniformly 45 min. by the hourly non-stop trains.

(5) Cross-Country Services.

This is another development in which a large share of the credit must be taken by the Great Central Railway, with a close ally in the Great Western: the genesis of many important cross-country services of to-day may be traced, directly or indirectly, to the opening, in 1901, of a short spur line connecting the Great Central Railway at Woodford with the Great Western at Banbury. Over this, almost from the opening, a through service was started between Southampton and York; in 1902 the Bournemouth-Newcastle through express commenced to run, and in 1905 that between Cardiff and Newcastle. Since the war all these have been revived, with the addition of the famous through "Eastern Group" working between Aberdeen and Penzance of 1921. The only Great Central service over the Banbury spur not perpetuated was one commenced to and from Dover in 1903. Of other well-known all-the-year-round workings, the "Sunny South Special" of the London and North Western and London, Brighton and South Coast Railways came into being in 1904; the Bournemouth-Birkenhead-Manchester trains commenced to operate in 1910

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and the London and North Western-Midland-Somerset and Dorset Joint Manchester and Liverpool to Bournemouth trains were started in the same year. All the foregoing services have been revived since the war, and other such services which both have, and have not been returned to the time-tables might be mentioned did space permit.

(6) EXPRESS EXCURSIONS.

Pages might be devoted to this fascinating topic alone. In endeavouring to attract custom the Great Central Railway was again well to the fore, and as far back as Easter, 1906, this enterprising line was running a corridor express excursion with restaurant car, from Manchester to Plymouth, worked non-stop between Banbury and Exeter, and throughout to Plymouth by a Great Central Railway engine. Later developments corresponding to this were the Midland third-class excursion from St. Pancras to Edinburgh, commenced in 1906, and latterly calling only at Nottingham outside Leeds (to change engines) and Ilkley as far as Carlisle, and also the Great Western Railway South Devon third-class "special" of 1913, non-stop to Newton Abbot. Both ran once a week, and were, of course, restaurant car trains. It was about 1906 that the long-distance day excursion was becoming the rage, day, or even half-day, trips being run once a week from London as far afield as Clacton-on-Sea on the Great Eastern Railway, Skegness on the Great Northern Railway, Matlock on the Midland Railway, Weymouth on the London and South Western and Great Western Railways, and Weston-super-Mare, Malvern and elsewhere on the Great Western Railway. These excursions culminated in the famous Great Western Railway "Day Trip to Killarney" of 1907, wherein the train on the English side was a corridor restaurant car express, booked to run non-stop between Paddington and Fishguard in five hours—a luxury not even granted to the ordinary full-fare passenger! Little, however, of this kind of excursion enterprise has been seen since the war, as even in pre-war days it must have been conducted at the barest margin of profit; the principal result, indeed, was probably that of attracting a proportion of the excursionists subsequently as regular passengers taking their holidays to the points thus visited.

(7) MAIN LINE TRAVEL FACILITIES.

It is a far cry from the average main line express of 1897 to that of 1922 in point of luxury. Although the dining car had "come in" as far back as 1879 its use was still very limited. The East and West Coast morning Scotch expresses were in 1897 continuing to halt 20 min.

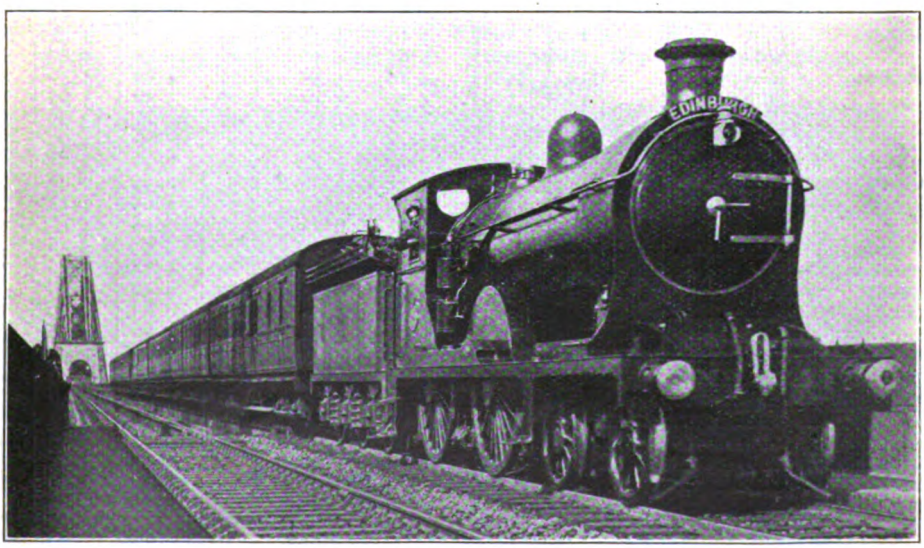

Photo.] NORTH BRITISH RAILWAY. [*Leslie J. Thompson.*

Perth–Edinburgh train leaving the Forth Bridge. 4-4-0 superheater locomotive No. 244, "Madge Wildfire."

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at York and Preston, respectively, for "lunch," and did so till the year 1900. The Great Western Railway could boast only *four* restaurant car trains daily, and those confined to first-class passengers, as were also the majority of the London

FASTEST TIMES BETWEEN LONDON AND PROVINCIAL TOWNS, 1897–1922.

Town.	Route.	Distance.		Fastest Time.				Fastest Booking 1897-1922.	Increase 1922 over fastest.
		July, 1897.	June, 1922.	July, 1897.	July, 1914.	Oct., 1918.	June, 1922.		
		miles.	miles.	h.m.	h. m.	h. m.	h. m.	h. m.	p.c.
Aberdeen ..	East Coast ..	523½	523½	11 05	11 05	13 30	12 00	11 05	8·3
,, ..	West Coast ..	540	540	11 15	11 15	N.S.	12 02	11 15	7·0
Birmingham ..	L. & N.W.R. ..	113	113	2 20	2 00	2 30	2 00	2 00	Nil
,, ..	G.W.R.	129¼	110½	2 35	2 00	2 30	2 00	2 00	,,
Bournemouth	L. & S.W.R. ..	108	108	2 23	2 00	2 35	2 15	2 00	12·5
Bradford ..	G.N.R.	193¼	193¼	4 03	3 56	4 50	4 15	3 40	15·9
,, ..	Midland Rly. ..	203½	198	4 35	4 13	5 55	4 33	4 13	7·9
,, ..	G.C. & L. & Y. ..	—	208	N.S.	4 42	5 00	4 54	4 30	8·9
Brighton ..	L. B. & S.C.R. ..	51	51	1 05	1 00	1 15	1 00	1 00	Nil
Bristol ..	G.W.R.	118½	117½	2 15	2 00	2 15	2 00	2 00	,,
Cambridge ..	G.E.R. ..	55¾	55¾	1 13	1 11	1 19	1 15	1 10	7·1
Cardiff ..	G.W.R.	157¼	145¼	3 17	2 50	3 10	2 52	2 50	1·0
Carlisle ..	L. & N.W.R. ..	299	299	5 50	5 48	6 45	5 58	5 48	2·9
,, ..	Midland Rly. ..	309	309	6 30	6 05	7 28	6 23	5 59	6·1
Edinburgh ..	East Coast ..	393	393	7 45	7 45	9 40	8 29	7 45	9·5
,, ..	West ,, ..	400	400	8 00	8 00	N.S.	8 30	8 00	6·3
,, ..	M. & N.B.R. ..	407¼	407¼	9 15	8 40	10 44	9 12	8 20	10·4
Exeter ..	G.W.R. ..	193¾	173¾	3 43	3 00	3 30	3 00	3 00	Nil
,, ..	L. & S.W.R. ..	171¾	171¾	·3 55	3 14	3 57	3 25	3 12	6·8
Folkestone ..	S.E. & C.R. ..	*68¾	†70	1 35	1 29	2 00	1 25	1 25	Nil
Glasgow ..	West Coast ..	401½	401½	8 00	8 00	9 30	8 25	8 00	5·0
,, ..	M. & G. & S.W. ..	424½	424½	9 05	8 45	10 40	9 05	8 30	6·9
,, ..	East Coast ..	440¼	440¼	9 20	9 20	N.S.	9 45	9 20	4·5
Inverness ..	West ,, ..	593¾	567¾	13 30	13 08	15 55	14 25*e*	12 50	12·4
,, ..	East ,, ..	584¾	558¾	13 15	12 53	N.S.	14 45	12 40	16·5
Leeds ..	G.N.R.	185¾	185¾	3 49	3 25	4 32	4 00	3 25	14·6
,, ..	Midland Rly. ..	196	196	4 00	3 40	4 47	3 55	3 33	10·3
Leicester ..	,, ..	99	99	1 55	1 45	2 15	1 47	1 45	1·9
,, ..	G.C.R.	—	103	N.S.	1 49	1 56	1 49	1 45	3·8
Liverpool ..	L. & N.W.R. ..	192¼	192¼	4 15	3 35	4 45	4 00	3 35	11·6
,, ..	Midland Rly. ..	218¾	217½	5 05	4 22	N.S.	4 40	4 10	12·0
Manchester ..	L. & N.W.R. ..	‡183½	‡183½	4 15	‖3 30	‖4 35	4 00	‖3 30	14·3
,, ..	Midland Rly. ..	190¾	189¾	4 20	3 40	5 08	3 56	3 35	9·8
,, ..	G.C.R.	—	§212¼	N.S.	§4 10	§4 45	§4 25	¶3 50	15·2
,, ..	G.N.R. ..	§209¼	§209¼	¶4 15	¶4 08	N.S.	N.S.	§4 00	—
Newcastle ..	G.N. & N.E.R. ..	268½	268½	5 17	5 13	5 55	5 39	5 12	8·8
Norwich ..	G.E.R.	115	115	2 31	2 26	2 54	2 34	2 22	8·5
Nottingham	Midland Rly. ..	123½	123½	2 23	2 12	2 55	2 15	2 12	2·3
,, ..	G.C.R.	—	126½	N.S.	2 23	2 27	2 16	2 11	3·8
,, (*a*) ..	G.N.R.	127¾	127¾	2 33	2 32	N.S.	††2 54	2 22	††22·5
Parkeston Q.	G.E.R. ..	69	69	1 25	1 22	2 04	1 22	1 22	Nil
Penzance ..	G.W.R.	325¼	305¼	8 32	6 30	7 55	6 30	6 30	,,
Perth ..	West Coast ..	449¾	449¾	8 55	9 00	11 05	10 05	9 00	12·0
,, ..	East ,, ..	440¾	440¾	9 20	8 58	N.S.	9 50	8 58	9·7
Plymouth (*b*)	G.W.R. ..	245¾	225¼	5 07	4 07	5 00	4 07	4 07	Nil
,, (*b*) ..	L. & S.W.R. ..	230¾	230¾	5 28	4 53	5 51	5 36	4 40	20·0
Sheffield ..	G.C.R.	—	164¾	N.S.	2 57	3 22	3 06	2 50	9·4
,, ..	Midland Rly. ..	158¼	158¼	3 18	3 00	4 01	3 15	3 00	8·3
,, ..	G.N.R.	161¾	161¾	3 09	2 58	4 09	††3 35	2 50	††26·5
Southampton	L. & S.W.R. ..	79¼	79¼	1 40	1 38	1 43	1 32	1 32	Nil
York ..	G.N.R.	188	188	3 35	3 35	4 00	3 47	3 35	5·6

* ex Cannon Street. † ex Charing Cross. ‡ Via Stoke. ‖ Via Crewe, 188¾ miles.
§ Central Station, Manchester. ¶ London Road Station, Manchester, 6¼ miles less than Central. (*b*) North Road Station. (*a*) London Road Station. N.S. = No Service. †† No competitive service now run, by agreement with Great Central Railway. (*e*) 15 min. less in Summer, 1921.

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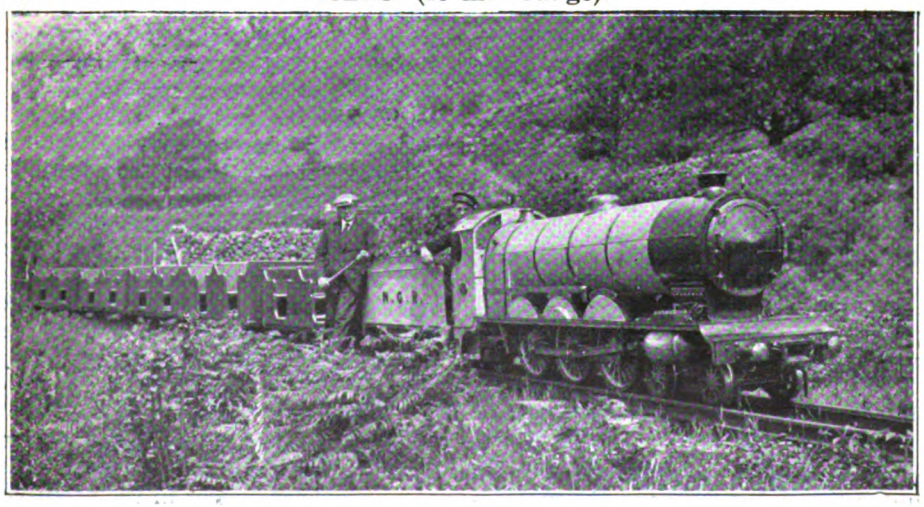
and North Western 16 daily restaurant car trains! The Midland Railway had 14 restaurant trains running daily, the Great Northern Railway 12 (of which 4 worked in each direction between King's Cross and Manchester), and the Great Eastern Railway 2; on the London and South Western Railway were found 6 and the London, Brighton and South Coast Railway 28 daily Pullman car trains. But from the beginning of the century restaurant car business, save for the interruption caused by the war, has been constantly on the increase, until we can now number nearly 500 daily trains incorporating either restaurant or Pullman cars in their formations. Here again, the "slogan" of the Great Central Railway on opening to London—"Rapid Travel in Luxury"—with its outcome—"Every Express Train Vestibuled, with Buffet Car Attached"—was, doubtless, not without its strong influence on developments elsewhere. There has not, of course, been the same scope for increases in sleeping car facilities owing to the comparative shortness of most British journeys. Corridor trains, which were in their infancy in 1897, are to-day used almost universally on the majority of lines in all the fast trains, and often in slow train formations also; similarly, the ubiquitous six-wheeler—found in large numbers even in East Coast Scotch expresses of 1897!—has given place to the smooth-riding bogie vehicle.

The slip coach was considerably more popular in 1897 than we find it to-day, although it will be readily understood that a "slip guard" was not so costly a luxury in those days as he is now. In 1897 the Great Western Railway slipped 43 coaches daily; the Great Eastern Railway, 23; the Midland, 11; the Great Central Railway, 8; the Great Northern Railway 7; the London, Brighton and South Coast Railway, 5; the London and North Western Railway and Lancashire and Yorkshire Railway, 4 each; the London, Chatham and Dover Railway and the Northern Counties Railway of Ireland, 3 each; and the Great Northern Railway of Ireland and the South Eastern Railway, 1 each—total, 113. Before the war the total figure had reached 178 even though the English Great Northern Railway and the London and South Western Railway had dropped out. Since the war we have only got back to 67 "slips" daily (of which the Great Western Railway claims 29 and the London, Brighton and South Coast Railway, 22); the Midland, London and North Western, Great Eastern Railway, Great Central Railway, and the Northern Counties (Ireland) Railways have now joined the railways which have ceased, or practically ceased, to make use of the slip coach.

THE SMALLEST "PUBLIC" RAILWAY IN THE BRITISH ISLES (15-in. Gauge).



A SCENE ON THE ESKDALE RAILWAY.

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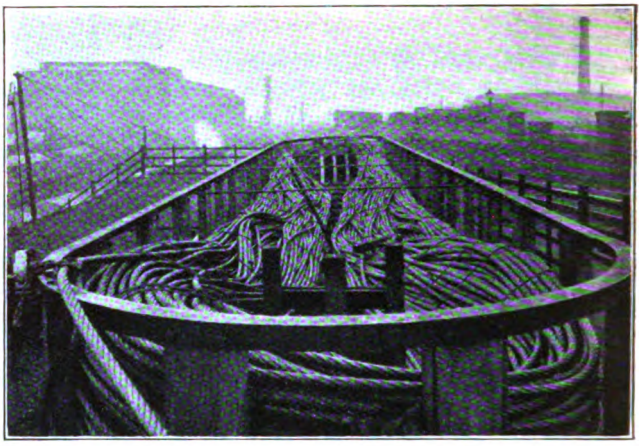
The Revolution in Traffic Working Methods Since 1897.

By CHARLES TRAVIS, M.Inst.T.
(Joint Author of "Practical Railway Working," "Railway Operating Economics," etc.)



A CABLE FOR THE GLASGOW CABLE SUBWAY, LOADED FOR TRANSIT BY RAIL.

AS one who has from time to time contributed articles on railway operating to the RAILWAY MAGAZINE, I have been asked to describe the revolution in traffic working methods since 1897—twenty-five years ago. A short span in the life of a nation, this period is a goodly proportion of railway history, as railways do not celebrate their centenary until September, 1925, and it would require far more than the space at my disposal for me to discuss in any detail the many improvements in operating methods introduced since 1897.

I propose then merely to indicate the chief modern developments and make brief reference to earlier methods; and especially to stress the present and potential utility of the systems of train control, and their effect upon railway organisation. There can be little doubt that the more or less general adoption of train control is the most potent factor towards improvement, but it should not, from that, be thought that our railways were badly operated at the earlier period. In fact, some competent observers go so far as to say that, if the mechanical and electrical improvements of the last twenty-five years be ignored, the railways were operated better then than they are to-day. This argument is open to question, but I will not pause to deal with it.

RAILWAY METHODS IN THE NINETEENTH CENTURY.

Speaking roughly, it would not, I think, be unfair to say that 1897 and the succeeding few years represented the high-water mark of competitive railroading, and, quite naturally, railway operating practice was based on this fact. Thus, speed of transit, whether it constituted economical transport or not, was thought to be of primary importance, while the manner in which traders were cultivated in those "good old days"—as the traders now feelingly term them—led to considerable and troublesome detention of stock, to the arrangement of expensive transits and, incidentally, to much friction between the various competitive railway companies.

It would be possible to narrate a few of the devices adopted by railway officials at important exchange points to place a competing line at a disadvantage, and also to give a few "trade secrets" that would, if not particularly instructive, be of some interest, but this hardly falls within the scope of the present article. Suffice it then to say that the present insistence upon *regularity* rather than *speed* of transit was not then recognised, while there was nothing like the present-day comprehensive system of co-ordinating loadings by means of scientifically designed systems of transhipment. Moreover, engine and train loads were much lower in 1897 than they are to-day, though even then they tended to outstrip the provision of refuge facilities, with the consequent danger of irksome delays leading to congestion.

PASSENGER TRAFFIC OPERATION.

On the passenger traffic side, nothing is perhaps more pronounced than the tremendous development in the arrangement of connecting services. The services, as

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such, are not my present concern, but the traffic arrangements associated therewith necessarily must be mentioned. Whereas, in former days, connections although provided on a relatively wide scale, were somewhat loosely fixed up, the usual practice is now for them to be established on a most comprehensive basis. A long-distance main line train, served by its "tributary" trains, hands over its traffic to "distributing" trains all along the line, and the scheming out of the details so that these trains shall dovetail with the utmost efficiency—and economy—is a matter to which special attention has necessarily had to be given.

Again, the tendency of the times is for express trains to be given timings that, in general, are only slightly more favourable than those scheduled in the keenly competitive days. This is not disadvantageous to the interest of the public, who are now able to rely to a greater degree on the regularity of the services, which was sometimes lacking in the days of extravagant speeds. Passenger traffic is, in some respects, more difficult to handle on an economic basis than freight traffic, the former requiring to be afforded services to suit the public convenience, while the latter may, in a measure, be handled at the discretion of the railway companies. Thus close study and intense analysis of operating details have been impelled in order to reduce the cost of working passenger traffic. As the companies settle down in the new groups, and it becomes possible by more intensive arrangements to effect operating improvements, passenger traffic details will doubtless receive increased attention. While it is not likely the war-time innovation of specified routing will be re-introduced, it is highly probable that arrangement of co-ordinated services and timings based more particularly upon the requirements than on competitive grounds will enable the railway companies to secure needed economy and at the same time give improved services.

In a brief review such as this necessarily must be, it is impossible to do more than refer to one or two of the outstanding improvements in the methods of operating passenger traffic during the past twenty-five years. Four only need be touched upon as between them they cover the more important developments. Following the inauguration of a most extensive system of train control on the Midland Railway in connection with freight traffic working, the system was adapted to passenger train operation, and the two special points I would emphasise are (1) that by the excellent system of booked "paths" established, a high degree of punctuality was obtained, this, in the case of passenger trains, rising from 47·9 per cent. in 1916 to 87·0 per cent. in 1920. Such bald figures may signify little in themselves, but when it is appreciated that delay to an express train usually reacts cumulatively upon following and connecting passenger trains, and that such delays obviously have a serious effect upon the working of freight trains, the beneficial results of improved passenger train operation will be recognised. The second point is that, under the control scheme, the working at stations was scientifically studied, and a definite scheme of platform occupation worked out, specified arrangements applying at terminals and through stations. By this means, also, improved results were assured, and some figures were given in the December 1921 issue of the RAILWAY MAGAZINE to show the advantages thus secured.

Somewhat different in its application, but having for its object the same purposes, *viz.*, economy in engine power and avoidance of delay by ensuring more punctual working, is the passenger travel regulation scheme of the London and North Western Railway (Lancashire and Yorkshire section). This was introduced during the war for the more effective working of the heavy seasonal passenger traffic between Manchester and the industrial districts served by the Lancashire and Yorkshire Company and Blackpool, and as it coincided with the period when food rationing was in vogue, it was inevitable that the system should be termed "travel rationing." But it was not correctly described. The scheme, which I reviewed fully in the August, 1920, issue of the RAILWAY MAGAZINE, under the heading of "The Advance Booking of Travel," was a system devised as much for the comfort of the passenger as for the benefit of the railway company. It certainly necessitated the booking of seats in advance, and when the full complement of seats in any train had been taken up, it was obviously futile to issue more tickets.

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So prospective passengers had to decide to go by other trains. But the gain to the passenger arose from the fact that, after booking his seat, *he was assured of a seat*, and to those who have experienced the rush for the Blackpool trains at Manchester (Victoria) in pre-regulation days, that was surely an important consideration. I have not space for further elaboration, nor am I at liberty to quote figures illustrative of the operating economies secured, but I can add that the latter were of considerable importance, while there can now be no two opinions as to the utility of the scheme, both from the point of view of the passenger and the railway company.

Turning to suburban passenger traffic, reference may be made to the improvements in steam operated suburban traffic working on the Great Eastern and South Eastern and Chatham railways. In both cases electrification is obviously called for, but pending such developments, it became necessary to evolve some scheme that would enhance the carrying capacity of the lines which, during the rush hours, were very heavily worked. In both cases, important results have been secured. On the Great Eastern, the "Jazz" service, as it has facetiously been termed, has enabled the company to handle a vastly increased number of trains in and out of Liverpool Street, this result being secured by small detailed improvements, both in operating, signalling and locomotive details. Similarly, on the South Eastern and Chatham, where a system of parallel traffic working has been introduced, has there been improved working, and it is hoped shortly to deal with the scheme in the RAILWAY MAGAZINE.

Many important changes have occurred in regard to parcels and luggage traffic on the passenger side, including the passengers' luggage in advance, the London and South Western Railway "Checked Luggage," system mentioned last month, and in regard to cloak room and other facilities. Systematic arrangements for the reservation of individual seats and of compartments may also be mentioned.

Photo.] MIDLAND RAILWAY. [*R. D. Pollard.*

Goods Train on bank from Chapel-en-le-Frith to Peak Forest. 0–6–0 locomotive, No. 3285.

FREIGHT TRAFFIC DEVELOPMENTS.

There have been so many important developments on the freight side that it is perplexing to know which to single out for special reference. Engines have become heavier, trains longer and, on the other hand, the unit of traffic has, if anything, tended to decline, the result being that to-day we are possibly utilizing more

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extravagant methods than in 1897. But that is not a fault of the railway companies. They have implored, cajoled and entreated the trader to consign in bigger loads, but he retains his touching belief in that "bulwark" of British trade—the hand-to-mouth policy of business, which necessarily means small consignments. One result has been the establishment of an elaborate system of transhipping stations, where loads of sundry goods could be sorted and reloaded to better advantage, and since the opening of Crewe tranship shed in 1901, many others have been constructed.

As with the odd consignment, so with the odd wagon. As against the idea of running casually operated trains which were "refuged" at the discretion of signalmen, for the conveyance of odd wagons, modern practice tends to develop block train loads from yard to yard, and the distribution of traffic from the yards to adjacent stations and branches. The Wath Yard of the Great Central Railway is at once a concentration yard for loaded coal wagons and a distribution yard for empty wagons, while on the general freight side, the new Feltham yard of the London and South Western Railway has undoubtedly improved the handling of traffic on that line. In connection with the odd consignment, mention may also be made of the system of "directional flow" of traffic on the Midland, whereby trains running in one direction only do all the roadside station work.

Many attempts have been made to develop a larger scale of freight handling on British railways, but it must be admitted that they have been only partially successful. In the early years of this century, when the "Americanization" of British railways was being pressed forward with vigour, efforts were made to develop the use of high-capacity wagons, but except for service purposes and, to some little extent, for coal and the heavier traffics, it cannot be said that they have been successful. Our conditions differ so essentially from those operative in America that high-capacity wagons do not generally prove an economical proposition. The American train load grew from 226 tons in 1898 to 352 tons in 1908, 638 tons in 1918 and 780 tons in 1920. Surely, a tremendous achievement. On the contrary, the average British train load in Great Britain is now about 150 tons, but that this is being developed is shown by the fact that the North Eastern, for example, improved its average train load 16½ per cent. between 1913 and 1920. Of course, train loads must always be considered in conjunction with the average haul, and whereas this in the States is 316 miles, the British parallel is 57 miles! And this difference accounts for much.

Our average freight train load is low, as I have indicated, owing to the peculiar conditions of railway working in this country. Our complicated railway system at present comprising many individual companies with scores of exchange points, preclude the possibility of securing high average freight train loads, and especially is this so when we hear from the traders themselves that it is not their intention to bulk traffic but to compel the railway companies to carry traffic in the manner they, the traders, wish to consign it. When the companies are amalgamated in the larger systems under the grouping scheme, there will doubtless be a considerable improvement in train loading, and this should have the effect of enabling the companies to secure certain operating economies. At the same time it should not be thought that the train load in Great Britain is not being developed. There are now several booked workings of freight trains with gross loads up to 1,400 or 1,500 tons, and while such bookings are, of course, timed on a relatively slow running basis, there are also express goods trains, having an overall timing of 41½ miles per hour, and a load of 800 tons behind the tender, being hauled on a regular 178-mile schedule by the Great Northern. In connection with this question of loading, it might be added that in this country there is a strong body of opinion in favour of limiting freight train loads where they have to negotiate tracks also used by express passenger trains, as delays to the heavier freight trains have such a cumulative and expensive effect on both passenger and freight traffic operation.

The capacity of yards, loops and sidings is also of importance in connection with the speed and length of freight trains. It is of no advantage to run longer trains if the yards cannot handle the traffic sufficiently rapidly. Another question is the permissible axle load on British railways. This

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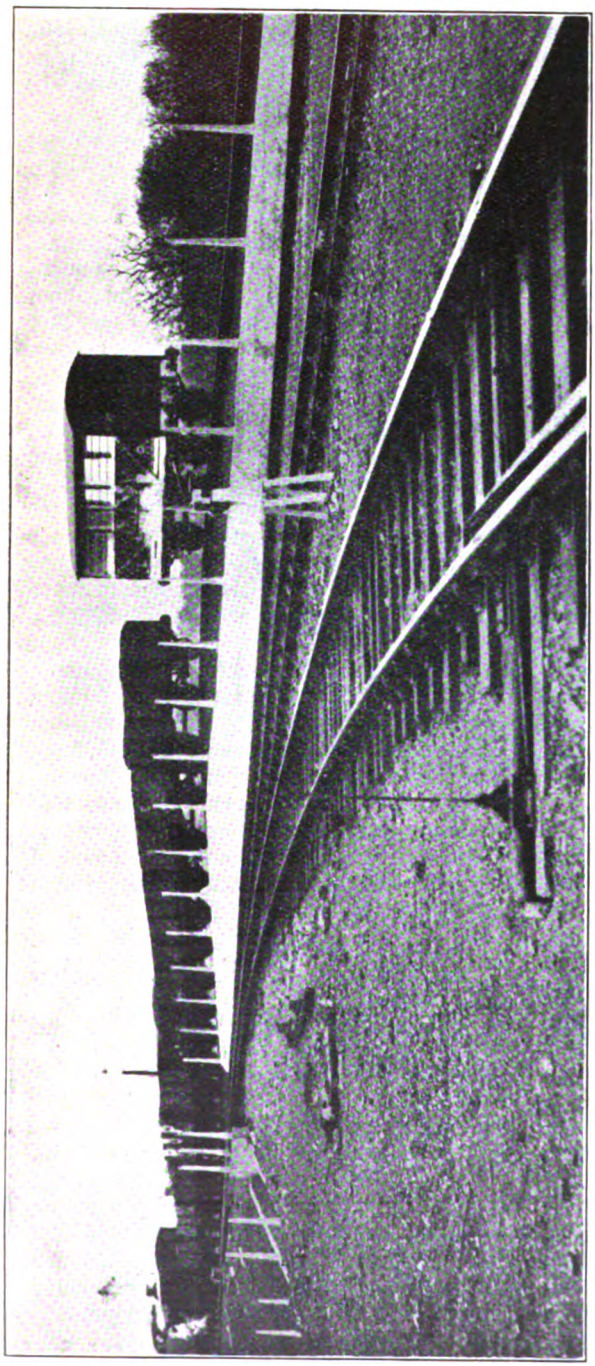
largely boils down to a question of bridge strengthening, as axle loads up to 28 tons could safely be allowed on 100 lb. section rails with sleepers spaced 2 ft. apart. The investigations now proceeding into the question of loading gauge and related questions will doubtless deal with this, as the replacement of the older bridges and the strengthening of the tracks would pave the way to an increase in axle loads and lead to bigger freight train loads.



HUMP SHUNTING AT FELTHAM, LONDON & SOUTH WESTERN RAILWAY.

In taking steps to improve line conditions, however, emphasis should be laid upon the necessity of developing terminal facilities in due correspondence therewith. It is no use at all working traffic more speedily over the lines if trains, on approaching their destination or any immediate yard, have to be "refuged" owing to shortage of accommodation at terminal points. Instances could be given to show how lack of attention to this question has resulted in very serious congestion, but it may be sufficient here to say that so long as the need for reasonable capacity at terminal points is recognised, the trouble will not arise.

A relatively recent development is the adoption of a scheme for the common user of wagons on British railways, and there can be little doubt that in its more extended form this scheme has proved of considerable advantage. It has diminished very considerably the amount of empty and cross haulage. An instance of this recently came under my personal notice. The Scottish companies, through their joint common user office, which co-ordinates records for comparison with the English companies, were able so to adjust their debits and credits that actually not a single wagon in a particular week was required to equalise the flow as between England and Scotland. At the same time, certain companies are not too pleased with the operation of the common user scheme, and there can be

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little doubt that from their point of view there is a lot to be said against it. As, however, it has many advantages, it is to be hoped that the scheme will be continued under grouping, although there will not then be the same necessity as under the *regime* of many independent lines, and it is understood that the rolling-stock experts of the various companies are at present studying the question from that point of view.

The Development of Train Control.

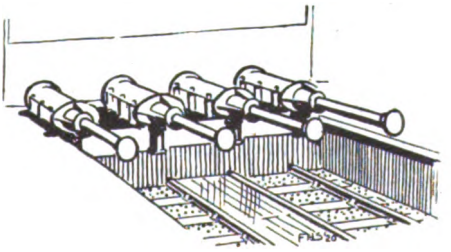
As I remarked in the introduction to this article, there can be little doubt that train control is the most potent factor towards improved railway traffic methods, and those who perused the three articles on the Midland system of Train Control, which were published in recent issues of the Railway Magazine, and observed the figures therein included, will appreciate the extent of the economy secured. The train control system, in brief, enables a closer check on the use of engine power, hours of trainmen and other operating staff (a matter of importance in view of the eight-hour day), and, incidentally, secures a more efficient transit of passengers and goods. In the past, as is well known, relief arrangements were of a most haphazard character, whereas now under a system of train control, the men's working hours are being closely watched all the time they are on duty.

The most comprehensive train control systems in operation in this country are those on the Midland and the London and North Western Railways (Lancashire and Yorkshire section), and it is interesting to note, as showing the utility of control, that, as Mr. Arthur Watson recently explained in a lecture before the Institute of Transport, Lancashire and Yorkshire experience showed that, of the very large number of telephonic communications flowing each 24 hours, more than two-thirds were messages of inquiry for assistance, and less than one-third instructions by the controllers. A measure of control of mineral train working was established on the Caledonian Railway in 1890, while the District Railway started a control system in 1905; but the Midland was the first British main line to adopt train control on a large scale, this being commenced on January 4, 1909, an installation on the Great Western being opened a week later.

Traffic Working in Future.

In conclusion, it may, I think, definitely be said that in latter years there has been an increasing tendency to deal with traffic working on a more scientific basis, and there can be no doubt that as a consequence of the intensive study of details and the building up of comprehensive programmes before inaugurating the actual working, striking results have been secured. This applies to many lines, and it would be invidious to single out any particular one for special mention. Under the grouping scheme there are sure to be many considerable changes in traffic operating arrangements. The obliteration of "frontier" points will enable longer hauls to be negotiated with facility, while the greater magnitude of each company's system will enable loads to be co ordinated on a broader basis, both of which points should tend to realise bigger loads and longer leads—the most desirable features of effective traffic working.

In an early issue of the Railway Magazine it is hoped to publish an article dealing with "Recent Developments in British Railway Practice" on a more comprehensive scale, and outlining a little more fully the probable tendencies of the future.



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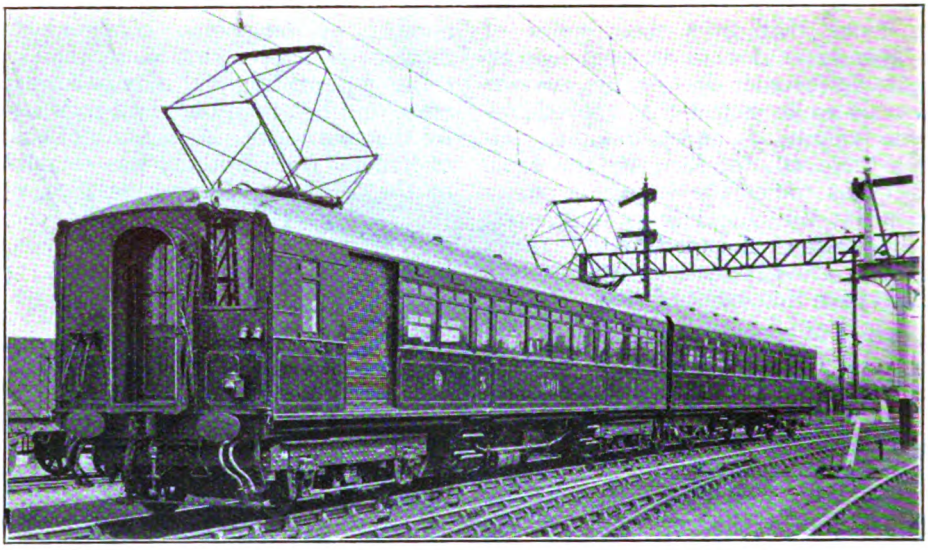

HIGH-TENSION D.C. EXPERIMENTAL ELECTRIC TRAIN, BURY AND HOLCOMBE BROOK SECTION, LONDON & NORTH WESTERN (LATE LANCASHIRE & YORKSHIRE) RAILWAY.

Twenty-Five Years Development of Electric Traction.

By Colonel H. E. O'BRIEN, D.S.O., B.Sc., M.Inst.C.E., M.I.E.E., Electrical Engineer, London & North Western Railway.

WHEN the first number of the RAILWAY MAGAZINE was published in July, 1897, electric traction, not only in England, but also abroad, was still in its infancy. The pioneer applications of electricity to traction purposes were effected in Ireland in 1885, tramways at Newry and Portrush being equipped with a 250-volt. third rail, unguarded and unprotected. The writer's first introduction to electric traction took place at Portrush in 1889, when he was misguided enough to use the third rail as a handy step for climbing a wall after a tramp on the beach, which had resulted in shoes thoroughly saturated with salt water. In 1897 the City and South London had already been in service for seven years, the Liverpool overhead for four years, while the Waterloo and City and the Blackpool and Fleetwood railways were in the preliminary stages of construction. In the twelve years that had elapsed since the Portrush tramway opened little progress in electric traction had, therefore, been made in England.

Matters had however progressed further in the United States of America, the Baltimore and Ohio Railway had equipped a tunnel section, four miles in length, with a top contact third rail at 650 volts D.C. and the Chicago overhead railway was running multiple unit trains from a 500-volt D.C. third rail. The control of these trains was effected on what was known as the Sprague system, in which each motor car was equipped with a tramway type controller, which was revolved by a small pilot motor, the pilot motor on each car revolving in synchronism under the control of a master controller in the leading car. Owing to various difficulties this control went out of favour and was succeeded by a contactor type of control in which each individual switch contact was made by the movement of an electro-magnet actuated by the action of a master controller in the leading car; this contactor type control has persisted for twenty years, but recently there has been a reversion to a modernised Sprague control, now termed a cam control.

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The opening of the Central London Railway in 1900, and the electrification of the Metropolitan and the Metropolitan District in 1904–5, the latter, after a long inquiry at which the respective merits of three-phase and direct current motors were hotly debated, gave a fresh impetus to railway electrification in England, which was aided by further developments in the United States and on the Continent, not only in electric traction, but also in the direction of higher transmission voltages from generating station to sub-stations. The three years between 1900 and 1903 saw the opening of such high speed inter-urban railways on the third rail 600-volt. D.C. system as the Aurora, Elgin and Chicago and the Milan Gallarate. The development of the modern traction motor with solid mica insulation for the armature coils, a totally enclosed steel carcase, and wheelbarrow suspension was completed in these years, and the designs then adopted have been changed but little since, except in detail, the one great subsequent forward step being the introduction of interpoles. The period 1903–1908 saw the awakening of the more progressive English railway managements to the advantages of electric traction for suburban services and the electrifications of the Mersey Railway, the Liverpool and Southport section of the Lancashire and Yorkshire (now London and North Western) Railway, the Newcastle Tyneside lines of the North Eastern Railway, the Metropolitan District, the Metropolitan, and the Hammersmith and City Railway (Great Western and Metropolitan Railways joint, the former providing the power station and operating a short intermediate section of its own lines), followed in quick succession, all on the conventional lines of three-phase 7,000-11,000-volt 25-period A.C. transmission with conversion at sub-stations to 600 volts D.C. With the exception of the Liverpool and Southport line which adopted a tramway type controller, control systems of the contactor type were used in all these cases.

During this same period, while suburban and inter-urban lines had multiplied rapidly in the United States of America, the Americans had also undertaken two trunk line electrifications on the New York Central and the New York, New Haven and Hartford. Whereas the suburban electrifications referred to had been prompted by economic and commercial considerations these two trunk line electrifications came in a different category, having been forced on the railways by the problems of tunnel ventilation in their approaches to New York and by the New York City ordinances prohibiting smoke production within the city area.

ELECTRIC RACE TRAIN AT AINTREE, LONDON & NORTH WESTERN (LATE LANCASHIRE & YORKSHIRE) RAILWAY.

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At this time the progressive electric manufacturing companies, urged on by the success of their applications of single and three-phase motors to industrial purposes, began to devolop these motors for traction purposes. The possibility of eliminating the stationary rotary converter sub-station and the third rail, always an unpleasant obstacle on the track, by delivering high tension alternating current direct to the trains.and there transforming it to a low pressure for use in the motors, was an attractive one, though it presented problems of great difficulty and novelty. In Europe, particularly in Italy, there was a general tendency to use the three-phase system, and from 1906, when the Simplon Tunnel was equipped for three-phase traction, up to the present day, most of the electrifications in Europe have been carried out on one or other of the alternating current systems. In England only two railways followed the Continental lead. In 1909 the London, Brighton and South Coast Railway electrified their South London line on this system, and this was preceded in 1908 by a short experimental line equipped by the Midland Railway b etween Lancaster and Heysham.

In the United States of America the single-phase, the three-phase and the direct current systems were all used. Up to the year 1910 the limit of voltage used for direct current third rail or trolley work had remained at 650 volts, but in 1911 the General Electric Company (U.S.A.) equipped a line at 1,200 volts D.C. for the Southern Pacific Railway. This electrification marked a distinct advance as far as direct current traction was concerned, as doubling the voltage quadrupled the distance between sub-stations for a given drop in voltage, thus enabling a larger number of trains to be fed from each sub-station, which obviously improved the load factor on the sub-station, thus reducing capital and running costs.

In 1913 a further advance was made. In England the Lancashire and Yorkshire Railway electrified experimentally a four-mile length of line from Bury to Holcombe Brook at 3,500 volts D.C. Two cars were provided, each equipped with four 1,800 volt motors coupled permanently in series in pairs. The Lancashire Power Company provided the supply to a sub-station containing a motor-generator, 3,500 volts D.C., which fed the trolley line. This experimental electrification, which

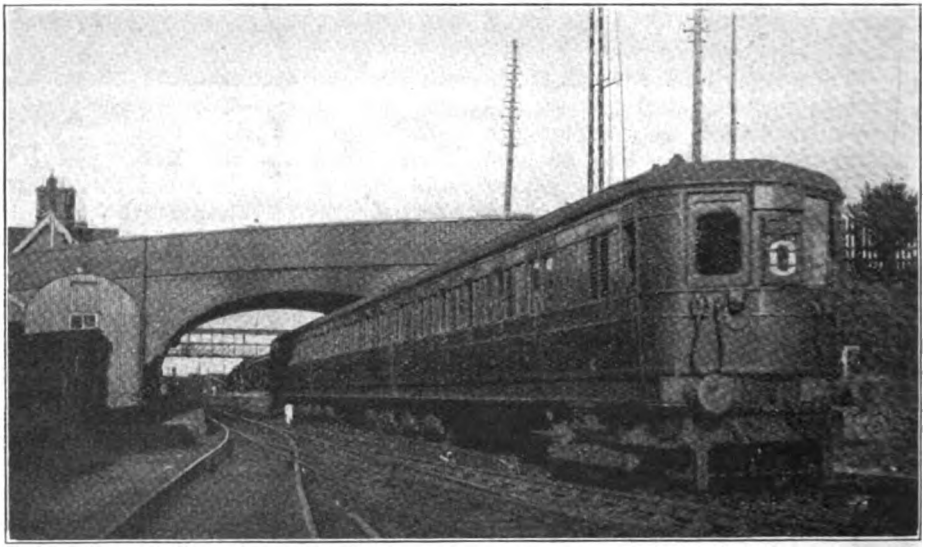

Photo.] **LONDON & SOUTH WESTERN RAILWAY.** [*F. H. Stingemore.*

Electric Train Leaving Hounslow.

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was designed by and due to the initiative of an English electrical firm, worked with the greatest success, but the system was not perpetuated owing to the decision to electrify the Manchester and Bury line in 1916 with a 1,300-volt third-rail system. This decision was arrived at on account of the great physical difficulties of equipping main lines in the neighbourhood of Manchester with an overhead trolley and the consequent expense. The stock for this railway was constructed entirely of steel and aluminium, and was the first all-metal electric stock to be built in Great Britain.

Almost simultaneously the Butte, Anaconda and Pacific Railway, 25 miles in length, was electrified at 2,400-volts D.C. This is a mineral line, and its electrification marked the first application of high direct current voltage to heavy goods locomotives. Two years later, in 1915, the Chicago, Milwaukee and St. Paul commenced the electrification of 650 miles of their main line across the Rocky Mountains on a 3,000-volt D.C. system with a 100,000 volt A.C. transmission to the sub-stations, which contained motor-generators not rotaries.

The controversy that arose in 1908 over the respective merits of the single-phase and direct current undoubtedly gave rise to some hesitation on the part of the British railways in proceeding with electric traction schemes. By 1913, however, the majority of English engineers seemed to have made up their minds that the direct current system was most suitable to English conditions; during 1914–16 the London and North Western Railway electrified their North London and Watford suburban lines, inaugurating through working from the London Electric Railway in 1915, while the London and South Western carried out the electrification of 47 miles of suburban track commencing in 1915. It is interesting to note that whereas all electric stock hitherto built in Great Britain was on the American model of corridor stock with end doors, supplemented in the case of the Metropolitan and District by centre doors, the London, Brighton and South Coast and London and South Western Railways utilised existing steam compartment stock, the latter placing motor bogies underneath the coaches and constructing drivers' compartments at the ends, thus effecting a large economy in the capital expenditure on the electrification.

In 1915 the electrification of the only goods line up to the present electrified in Great Britain was commenced by the North Eastern Railway between Newport and Shildon. The operating results obtained by the North Eastern corroborated those obtained in the United States of America, which tend to show that under favourable conditions electric traction requires about half the number of locomotives required for steam traction, and that the coal consumption per ton-mile hauled is also reduced by about 50 per cent.

Some mention should be made of the rapid growth that has taken place in the size of the motors employed, particularly on locomotives. In 1903 a motor of 150 h.p. was considered a large size, to-day some of the Continental locomotives are equipped with motors of 2,000 h.p. Owing to the limitations of strength of drawbar on English railways and the physical features of the railways themselves, it is improbable that any English electric locomotive will ever require to have motors aggregating more than 1,600 drawbar horse-power.

In 1919 the Ministry of Transport appointed a Departmental Committee to investigate and report upon the position in regard to electrification in this country. The Committee heard witnesses, not only from the principal British railways but from many foreign ones.

Eventually they reported in favour of the universal adoption in Great Britain of a third rail 1,500-volt D.C. system, using an under-contact protected third rail, but made an exception in favour of the London, Brighton and South Coast single-phase system, which was to be permitted to extend. Since then proposals have been brought forward for the electrification of the South Eastern and Chatham Railway on a 3,000-volt D.C. three-wire system with two conductor rails.

It will be seen from the above outline of the progress of electric traction in Great Britain that a very large field remains untouched. Little mention has been made of the wonderful system of tube electric railways which has grown up in the last few years and so greatly improved the internal communications of London, but

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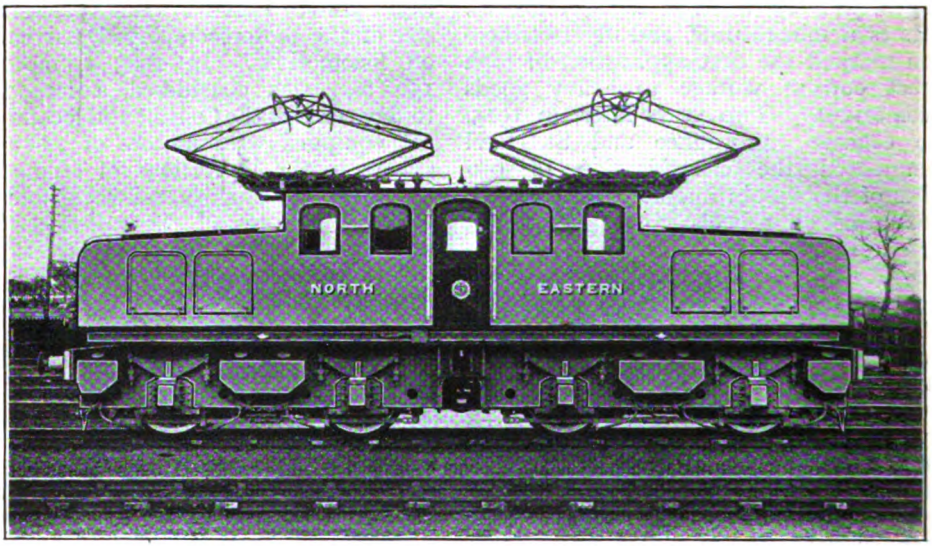
it will be evident that on the circumferential arc extending from Euston eastwards to Waterloo much remains to be done in improving the external suburban services. The Midland, Great Northern, Great Eastern, South Eastern and Chatham, have as yet no electrically operated suburban trains. In the provinces only Manchester, Newcastle and Liverpool have been provided each with one electrically-operated suburban railway; Glasgow, Bristol, Bradford, Leeds, Sheffield must also have fields yet untouched for suburban electrification. The problem of electrification, whether main line or suburban, is primarily a traffic problem and demands the solved, and the complete solution of this problem is at hand in the new types of rotaries that are being designed to-day, and in that interesting development of the mercury vapour arc lamp—the mercury arc rectifier. There should be a great future still in Great Britain for suburban electrification.

Main line electrification is still but a distant prospect except in special cases. The advantages are not of the same order as in a suburban service where there is an immense saving in terminal shunting operations and in actual time of transit. Main line electrification can only prove its worth where it is possible to utilise



ELECTRIC FREIGHT LOCOMOTIVE, NORTH EASTERN RAILWAY.

qualities of vision and courage on the part of the railway managements. Sir John Aspinall said: "I electrified the Liverpool and Southport line not to save money but to make it"; nobody can travel on that line and note the expansion of population that has taken place and doubt the truth of his remarks. Sir William Forbes, I believe, has re-echoed Sir John Aspinall's sentiment.

The technical side of suburban electrification is very cut and dried, it almost approaches standardisation; as regards the direct current system only the question of the conversion of alternating current at a frequency of 50 to direct current at 1,500 volts or 3,000 volts remains to be the three most advantageous characteristics of the electric locomotive: (1) Continuous service for 23 hours out of 24; (2) the maintenance of high uniform speeds on up grades; (3) the double heading of trains with a single engine crew.

Again the problem is primarily a traffic one, the traffic on a line to be electrified must be dense in order to efficiently cover the standing charges on transmission lines, sub-stations and track equipment; the engine workings must be arranged as to permit full advantage to be taken of the continuous service of which the electric locomotives are capable; the grades must be heavy to enable full

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advantage to be taken of the flexibility and efficiency of the electric locomotive.

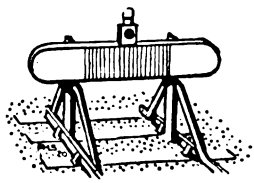
The capital cost of a main line electrification is in general so high in relation to the traffic density that, except in rare instances it can only be contemplated as an alternative to a widening. Happily for the future of electrification the advantages of the electric locomotive show up most on lines with long heavy grades, and in most cases such lines are those on which the cost of widening or extensive loops will be greatest and most prohibitive; the future of main line electrification lies, therefore, in the hill divisions of our trunk lines.

The dominant factor in deciding whether to electrify or not will be the capital expenditure on the sub-stations, transmission track and rolling-stock. The possibility of obtaining cheap current from super-power stations is a factor but not a dominating one, and is rather a question of convenience than anything else. In any railway electrification of magnitude the load factor is so good and the size of the generators required so sufficiently large as to make it possible for a railway company in most cases to generate as cheaply as any super-station.

Generally speaking the technical problems of main line electrification will not offer great difficulties for railway engineers who understand the conditions which they have to meet; it will be a difficult matter to decide on the relative merits of 1,500-volts D.C., 3,000 volts D.C., or 11,000 volts A.C., but probably local conditions will be the determining factor, the latter alternative will necessitate the use of an overhead trolley.

Controversy still rages in regard to the relative merits of overhead wires as against a third rail. The points on each side may be summed up as follows: the third rail is very easy to maintain and repair in case of derailment, at complicated junctions it is far cheaper than a trolley wire, it offers no obstacle to the operations of a breakdown crane; on the other hand it is a decided obstruction in the track and to shunters in particular. The overhead trolley is particularly susceptible to damage from derailments on lines with heavy goods traffic, it is liable to serious damage from a displaced collecting bow, it is a serious obstruction to the operations of a breakdown crane, it has to be carefully kept in alignment with the track it serves, it is very difficult to attend to on a line with dense and continuous traffic such as occurs on a main line.

The whole question may be summarised by stating that in general the economies to be effected by electrification do not balance the standing charges on the capital expenditure involved; other advantages have therefore to be looked for in the shape of increased traffic on suburban lines or the elimination of expensive widenings in the case of main lines: the preparation of the necessary estimates is a long and tedious business involving the co-operation of all departments, much experimenting on train resistance with a well-equipped dynamometer car, and the employment of a large and highly-skilled technical staff. The financial investigation alone into the existing operating costs of the particular section of line to be electrified is in itself a task of great magnitude. Unfortunately the financial aspect of the matter, which is the all-important aspect, has been somewhat neglected in the many discussions which have taken place in the press and elsewhere on this subject. Courage and foresight on the part of the commercial management of the railway companies is the essential to the further development of electric traction in this country. The engineers of the railways and the electrical industry are ready to do their part, but they can only point the way, the lead must of necessity fall to others.



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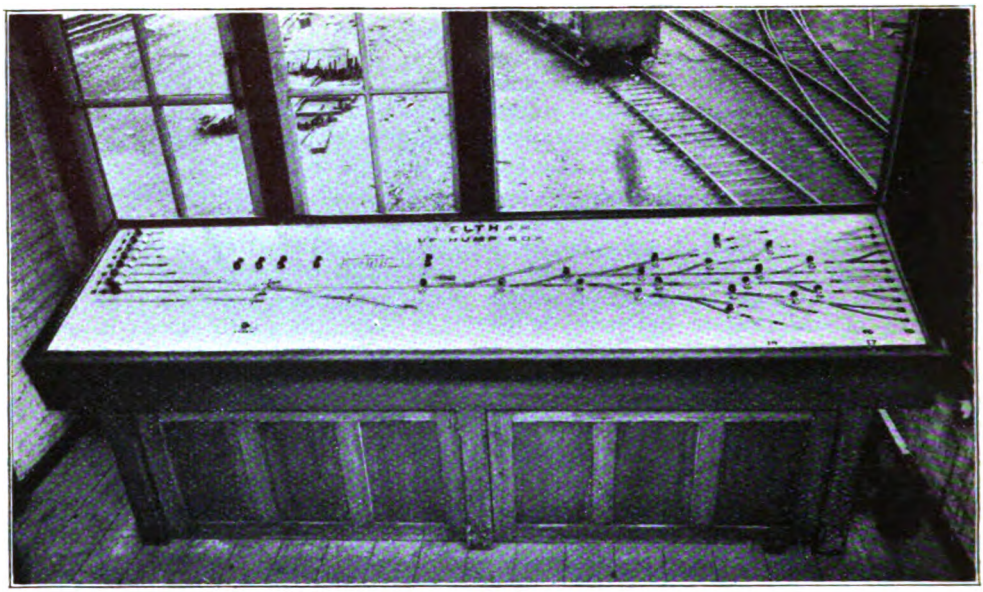

ELECTRIC DIAGRAM CONTROL BOARD, "UP" HUMP BOX, FELTHAM CONCENTRATION YARD, LONDON & SOUTH WESTERN RAILWAY.

Railway Signalling in 1897 and 1922.

By "INDICATOR."

NOTABLE as has been the development in other sections of railway practice, and especially in regard to electric traction, yet it is probably in connection with signalling that the greatest changes and progress have occurred during the past 25 years. It is true that a large part of the railway mileage of to-day is equipped with signalling not very dissimilar, if at all, from that installed and in use in 1897. Indeed, except for extensions of "lock-and-block," improvements in details of signalling mechanism and signalling instruments, and the now extensive use of track circuit in conjunction with ordinary as well as special signalling, with the multiplication of indicators and signalling adjuncts of various types, the general characteristics of usual manual signalling are not essentially modified. Even these, however, represent considerable development, especially as they have given rise to several special features now included in modern signalling practice.

Among such developments in what may be termed ordinary and manual signalling the extensive dependence now placed upon track circuit has perhaps had the greatest influence in signalling practice as a whole. Track circuit mechanism now employed is regarded as entirely reliable and not seriously costly in proportion to the benefits realised; but its use has relieved signalmen of much responsibility, has facilitated the provision of train movement indicators in many useful ways, and in combination with electrical (including illuminated) or electro-mechanical track diagrams has enabled the work of busy signalboxes to be very materially lessened and at the same time considerably expedited. Indeed, many of the busiest signal cabins, even where power signalling is not installed, are now operated almost without need for the signalmen seeing the trains they control, by the aid of track-circuit-controlled diagrams and various indicators. In addition, track circuit, or the equivalent application of

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lock-and-block, avoids the need for firemen of waiting trains to go to the signalbox, and this saves one source of much delay.

It is, however, the introduction of power signalling in its various applications which constitutes the greatest difference between the conditions of 1897 and those of to-day. Not that it is by any means universal, or even approximately so, for in an old-established country such as Great Britain, where a high standard of signalling has been insisted upon for several decades, it can only be where reconstruction or new equipment is undertaken that new plant can be installed, or where other reasons justify the expenditure involved. But in the course of the last 25 years many such works have been carried out, and in other cases a partial application of power signalling plant has been included, and, quite apart from true automatic or semi-automatic signalling, several important signalling undertakings of this class require brief mention.

Using the Sykes' system of electrically-operated signals, points being still worked normally, though with electric locks, &c., the first great installation was that at St. Enoch station, Glasgow, Glasgow and South Western Railway. Equally remarkable, and completed only a year or two later, is the similar installation at Victoria station, London, Brighton and South Coast Railway. The same system is also used at St. John's, Grove Park, and Folkestone Harbour, South Eastern and Chatham Railway. The Sykes' system was also used for many years, in conjunction with treadle contacts, as an automatic installation, between Praed Street and Gloucester Road, on the Metropolitan section of the Inner Circle in London, while the Waterloo and City Railway (now London and South Western Railway) has a somewhat similar system. It is interesting to note that the Sykes' "banner" signal, introduced first, we believe, at St. Enoch, Glasgow, is now very extensively used on many lines for controlling sidings, for platform and other repeater signals, and in other applications.

It is, however, with the working of large stations that power signalling has received its principal developments other than in association with automatic and semi-automatic signalling. In this connection pride of place must be given to the great installations carried out by the McKenzie, Holland & Westinghouse Power Signal Company (now the Westinghouse Brake & Saxby Signal Company, Limited), including those at Spitalfields goods depôt, Great Eastern Railway (one of the first), Bolton and Southport, Lancashire and Yorkshire Railway (now London and North Western Railway), Newcastle Central station, Tyne Docks and South Shields, North Eastern Railway, and Glasgow Central Station, Caledonian Railway. All these, together with a number of smaller installations, use electro-pneumatic apparatus (compressed air motors under electric control) for operating both points and signals. In some of these, too, route-indicating signals are used to avoid multiplying semaphore arms where a number of routes are available for trains at a particular platform or several platforms are served from one line.

The same firm has also developed a corresponding all-electric system, in which the points and signals are operated by electric motors, of which the installation at Victoria, South Eastern and Chatham Railway, is the most recent as regards large and busy stations. In the case of all-electric signalling several installations carried out by other firms must be mentioned, notably the Crewe electric system used at Crewe and Euston, and the Siemens system at Snow Hill, Birmingham, Derby, with others at Didcot and Yarnton, Great Western Railway. The British Power Railway Signal Company, which includes the British Pneumatic Railway Signal Company, has also been responsible for several all-electric installations, of which those at Immingham Docks and on the Keadby deviation line, Great Central Railway, may be mentioned.

The last-mentioned firm is principally associated, however, with the low-pressure pneumatic system. In this the point and signal motors are operated by motors using a comparatively low pressure, and the control is also pneumatic. Usually track circuit control is associated therewith, and in other cases the system is more correctly electro-low-pressure pneumatic. The principal installations are in the Manchester district of the Great Central Railway, and at Wath concentration yard of the same company, and on the London and South Western Railway

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between Grateley and Andover, between Woking and Basingstoke, at Salisbury and Staines, and at Clapham Junction and in the London district. To some extent these installations are automatic or semi-automatic, in that when points do not require to be moved for shunting or junctions to be operated, signalling proceeds more or less automatically.

There is, indeed, a great deal to be said for power signalling on busy lines and at large stations. In the former case the signals can operate automatically when trains are all moving on through lines, thus increasing track capacity and reducing signal cabin work, though when shunting is in progress or crossovers or junctions have to be operated the signalman has full control. At large stations the elimination of miles of surface rodding and of signal wires is an important consideration, fewer cabins are required, and a less number of men can control traffic more effectively, owing to the fact that the locking frame is small, all levers are brought close together, signalling procedure is simplified, and manual strain is almost entirely done away with. Points and signals can be operated at greater distances than under manual conditions, and interlocking can be made more complete without complication and various refinements introduced.

Automatic signalling is, in itself, merely the logical development of power signalling. It is a simple elaboration, as track circuit mechanism has come to be recognised as entirely reliable, especially on busy lines, and its development has proceeded side by side with the electrification of intense-traffic lines, particularly those in London and a few other corresponding lines, such as the Liverpool Overhead. Automatic signalling permits of signals being multiplied almost indefinitely, so as to shorten sections and enable trains to be run at very close headway. Otherwise, indeed, electric traction would be severely handicapped where such lines as the London "Underground" and "tube" railways are concerned, but by the aid of automatic signalling these lines can and do operate trains with absolute safety at the rate of 40 per hour on each line and even more occasionally.

In the case of the Metropolitan-District, London Electric, Central London, and Whitechapel & Bow Railways, the Westinghouse Brake & Saxby Signal Company's electro-pneumatic apparatus is thus applied, while on the Metropolitan Railway, East London, Mersey, Liverpool Overhead, Ealing and Shepherd's Bush, &c., the same firm's all-electric equipment is used. On the North Eastern Railway between Alne and Thirsk the Hall electro-gas system is used.

There are now many automatic intermediate signals to break up long sections, and a further development is the use of power apparatus to enable junctions to be worked from a station box at a distance by means of track circuit indicators and electric control thus enabling junction boxes to be closed when they are really only required for junction operation. At busy marshalling yards, too, the sorting sidings are now in some cases controlled by what may be termed diagram operating boards; the signalman operating the points by means of press buttons placed adjacent to the points controlled, as shown on the diagram, with electric light indicators to show positions of points and whether lines are clear or not.

Associated with power and automatic signalling is the growing favour of the upper quadrant type of signal, used systematically on the Metropolitan Railway, and three-position upper quadrant signals at Victoria, South Eastern and Chatham Railway, on the Ealing and Shepherd's Bush Railway, at King's Cross, Great Northern Railway, on the Keadby deviation line, Great Central Railway, and isolated examples such as that outside Paddington Station, Great Western Railway. Light signals, too, are now freely adopted on underground lines, and with hoods even in the open, while the Liverpool Overhead Railway has adopted light signals without hoods in the re-signalling recently completed. The use of yellow as the "on" indication of distant signals and for repeaters, and as the intermediate colour for three-position signals, is now general on the London underground lines and to some extent elsewhere, while it is being adopted also here and there in other cases. Experiments also being made with "position-light" are lights, by which groups of electric lamps are exhibited in series suggesting the true

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positions of a three-position semaphore arm.

To facilitate traffic working in fog several lines now use fog repeaters, electric lamp signals passed before signals they repeat are reached, and placed at a level suitable for convenient observation by enginemen and motormen.

Another development is the growing use of route-indicating or multiple-route signals, both mechanical and electrical to avoid the provision of a number of arms on one post, as when several platforms are served from one line. Also the installation of route lever signal frames, one lever controlling all signals and points of a given route, instead of calling for the operation of a series of levers for one train movement. Systems of this kind are now being introduced by Messrs. Siemens Bros. & Co., Limited, and by the British Power Railway Signal Company. Mention may also be made of the train indicators now provided for public information at London "Underground" stations, operating in conjunction with the magazine train describers installed at junction boxes, operated as trains proceed into the longer automatic sections.

THREE POSITION SIGNALS AT VICTORIA, SOUTH EASTERN & CHATHAM RAILWAY.

Reference may also be made to cab-signalling and automatic train control in connection with which important work has been done on the Great Western and North Eastern ("Raven" system) railways, and with the Syx, Daniels, Regan and other types of apparatus. In this connection the now standard use of trip gear on the London underground and tube lines is a matter of interest.

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Railway Side Lines.

By W. PARKER.

FIRST and foremost, railways as they exist in Great Britain to-day are Parliamentary-made monopolies for the conveyance of passengers, live-stock, merchandise and minerals. But the transport business carries in its train, so to speak, a number of auxiliary activities that do much to swell the enormous figures appearing year by year in the Railway Returns, while there are others not pursued directly for the purposes of pecuniary profit, but all the same forming part and parcel of the business engaging the attention of those concerned in or employed in the service of the great railway industry.

British railways, as dock and harbour owners, and as the proprietors of cross-channel passenger and cargo boats are in such a large way of business it seems almost stretching the point to allude to ramifications of such a magnitude as "side lines," although in the strict sense of the term that really is what they are. The establishment of railway dock properties and the launching of railway owned trans-channel vessels were both the natural sequence to the disturbing effect the inauguration of railway facilities had upon dock and channel navigation services as they existed in the days of the advent of the steam locomotive. All such services had to be completely re-organised in the light of the new state of things. Minor seaports waxed into mighty ones as the direct consequence of the excellent advantages acquired by widespread railway connections, while ports hitherto of consequence waned and became out-of-date because they lacked the railway outlet necessary for their trade.

Another necessity quickly apparent in early railway days was, that as a subsidiary side to the transport industry, the proprietors of the iron-road must enter into the hotel and catering business. From humble beginnings the early efforts of the railway refreshment departments have developed into mammoth concerns that embody hotels, luncheon, dining and tea-cars, to say nothing of the refreshment rooms at large stations and in some cases at small junctions.

As hotel proprietors the relative importance of the various railways in the British Isles may be judged by the amount of capital expenditure shown under this heading in their respective balance sheets. In those for the year ended December 31, 1921, it will be found that among English lines, the Midland Railway takes the premier place with a capital expenditure of £2,499,831, a sum near enough to be spoken of in round figures as two and a-half millions. Next come the lines controlled by the South Eastern and Chatham Managing Committee, *i.e.*, South Eastern Railway, £792,934; London Chatham and Dover Railway, £87,186; total £880,120. Capital expenditure by the Great Eastern Railway for hotels amounts to £837,230. To the £591,812 expended by the London and North Western Railway, by reason of the recent amalgamation must be added the £94,223 found in the accounts of the Lancashire and Yorkshire Railway, making a total of £686,035. Capital expenditure on other English railway hotels runs in the following order:—London, Brighton and South Coast, £406,246; North Eastern £352,877; Great Northern, £209,784; Great Central, £134,447; Great Western, £110,331; London and South Western, £92,245; Furness, £8,183; while the Taff Vale Railway, a Welsh line, since amalgamated with the Great Western Railway, gave on December 31 last its outlay as £6,036.

The Scottish Railways, in public-spirited endeavour to provide appropriate and adequate accommodation for tourists and travellers from afar, have been conspicuously enterprising in the direction of hotel proprietorship as is shown by the capital expenditure as follows:—North British, £668,694; Caledonian, £469,490; Glasgow and South Western, £309,410; Great North of Scotland, £167,077; and Highland, £152,543.

Turning to the Emerald Isle, one cannot refrain from reflecting that whatever its politicians may have done to

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deprive Ireland of the proper share of overseas tourist traffic its natural attractions deserve, the Irish railway companies have made most creditable attempts to attract travellers, not alone by persistent advertising, but by the provision and equipment of modern hotels. Under this heading Irish railways show figures that amply prove the point, viz.: Great Southern and Western, £166,417; Midland (Northern Counties Committee), £116,736; Belfast and County Down, £102,831; Midland Great Western, £70,803; Great Northern (I.), £63,489 and Dublin South Eastern, £34,719. It is to be hoped, whatever may be the position to-day, the time is coming when Ireland once more will be the happy hunting ground of the tourist with money to spend and that the railway hotels which are among the best on the other side of St. George's Channel will repay the enterprise and confidence of their proprietors, by what is commonly called "coming into their own."

Among the auxiliary activities of British railways there is one at the moment much to the fore in the public mind, and that is road transport. At present the railway companies exercising road transport powers are the Great Western, Great Eastern, North Eastern and the Great North of Scotland. Other railways are desirous of securing the right to use the public roads with the same freedom that is accorded all other payers of local rates, but as there are interested people who fear the competition in road transport that would be set in motion by the innovation, the claim of the railways to the usage of the roads for transport purposes is meeting with strenuous opposition. It is perhaps superfluous to remark that the ordinary collection and delivery of goods to and from railway stations is not in question. Of the existing road transport services by railway companies in Great Britain, the Great Western claims to be the pioneer. This company possesses 66 passenger motor vehicles, 257 goods and parcel motor vehicles and 18 horse omnibuses. These services, introduced as feeders to the Great Western lines of rails, are not confined to any particular districts served by the company's system. Full details of the services will be found in the *Railway Year Book*, 1922, on page 174. The North Eastern

GREAT WESTERN RAILWAY ELECTRIC DELIVERY VAN BEING CHARGED.

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Railway owns 24 passenger motor vehicles and 78 goods and parcels motor vehicles. Road motor services are in operation by vehicles belonging to the Great Eastern Railway, in connection with the company's trains between Harwich railway station and Upper Dovercourt, Ipswich and Shotley.

An excellent example of the way in which road motor services may be combined with railway transport is afforded by the Great North of Scotland Railway. This company owns 38 passenger motor vehicles and 11 goods and parcels vehicles. The road motor omnibuses for passengers and parcels traffic ply between Ballater and Braemar, Aberdeen and Cluny, Aberdeen, Echt and Midmar, Aberdeen and Newburgh, Alford and Strathdon, Huntly and Aberchirder, Fraserburgh, Rosehearty and Aberdour, and in summer between Ballindalloch and Tomintoul and between Ballater and Strathdon via Dinnet, which two services are connected by horse conveyance between Tomintoul and Strathdon. Motor lorry services for goods traffic are of great convenience to traders and others located considerable distances from the railway lines. One of the most pleasurable holidays for people of moderate means is to visit Scotland and enjoy tours by the motor coaches provided by the Great North of Scotland Railway.

The employment of staff has entailed the necessity of railways becoming house and cottage builders, and owners. To-day, some of the great lines own hundreds of houses, cottages and labourers' dwellings. The latter classes of buildings in most cases have been specially erected to meet staff requirements, but the better types of houses usually have been acquired by railways purchasing property in connection with widenings or railway extensions.

Following is a table giving particulars of British railways owning more than 1,000 houses or cottages. No Irish railway reaches such a figure although some lines in Ireland possess several hundreds of houses, notably the Great Southern and Western, 733, and the Midland Great Western, 501. In considering the figures it is necessary since the amalgamation on January 1, 1922 to take those of the Lancashire and Yorkshire Railway and the London and North Western as a whole, and in regard to those of the South Eastern Railway, it may be mentioned that in addition the South Eastern and Chatham Managing Committee owns 201 houses and cottages of different kinds and the London Chatham and Dover Railway, 203.

Railway.	Labouring class Dwellings.	Houses and Cottages for Company's Servants.	Other Houses and Cottages.
Caledonian	56	1,459	1,481
Glasgow and South Western	—	926	876
Great Central	434	597	1,081
Great Eastern	390	1,322	256
Great Northern	209	1,356	742
Great Western	206	1,464	1,135
Lancashire and Yorkshire	476	752	2,539
London and North Western	752	4,325	3,987
London and South Western	575	1,544	553
London, Brighton and South Coast	419	809	172
Midland	592	2,608	1,830
North British	483	1,708	1,502
North Eastern	519	4,592	1,282
South Eastern	761	1,086	1,492

In addition to the well-known railway-owned Cross-channel services some of our railways possess vessels of quite a different character. Thus the steamers plying on Loch Lomond are the joint property of the Caledonian and North British Railways, while the Furness Railway has two passenger boats on Coniston Lake and five passenger and one cargo boat on Lake Windermere. The Great Eastern Railway,

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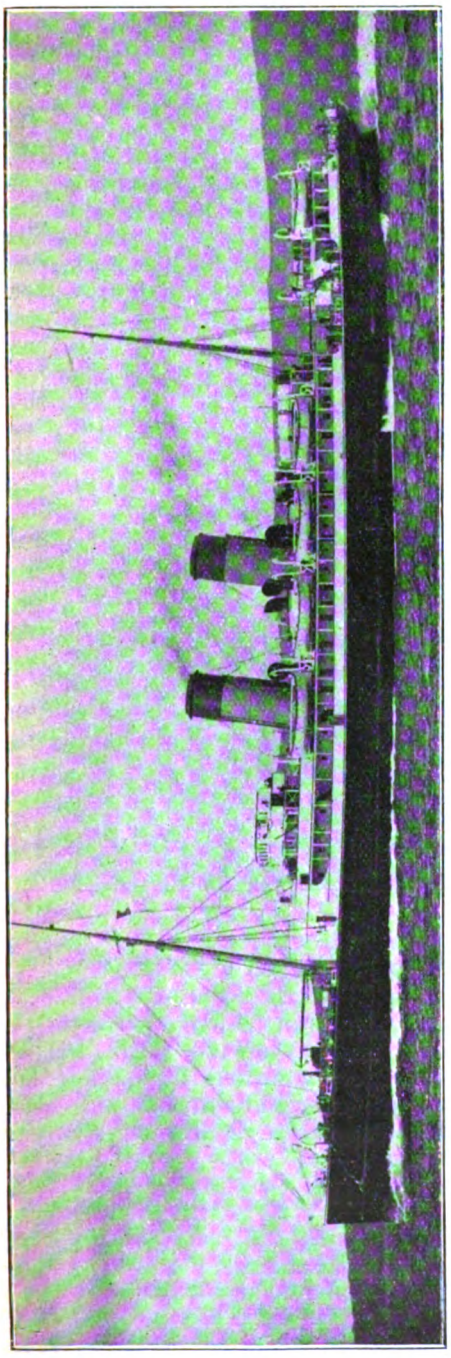
in addition to its splendid fleet on the Harwich-Continental services, has two



LONDON & NORTH WESTERN RAILWAY CROSS-CHANNEL TURBINE STEAMER "ANGLIA."

paddle steamers for passengers between Ipswich, Harwich and Felixstowe, and three motor boats for passengers between Harwich, Shotley and Felixstowe. Companies like the Great Western and London and South Western owning fine fleets in the English Channel are not without their small fry also. Mention may be made of the Great Western's ferry-boat *The Mew*, at Kingswear and the London and South Western boats on the Lymington and Yarmouth (Isle of Wight) service. The London, Brighton and South Coast Railway owns, jointly with the French State Railway, the steamers plying on the Newhaven-Dieppe route and also the English Company is joint owner with the London and South Western Railway of the boats in service between Portsmouth and the Isle of Wight. The Midland Railway first became a maritime company by establishing on September 1, 1904, the Heysham-Belfast service, but by absorbing the London, Tilbury and Southend Railway in August 1912, it embraced the boat service between Tilbury and Gravesend, carried on by some half-dozen steam vessels. The North Eastern Railway is largely interested in shipping, not so much by owning vessels in the same way as the London and North Western Railway—particularly now the Lancashire and Yorkshire is amalgamated with the latter—but by the investment of capital in certain shipping lines.

A curious instance of divided ownership of boats in connection with railway working is provided by the two turbine steamers on the Larne and Stranraer service. The Portpatrick and Wigtonshire Joint Railways own four-fifths, the remaining share being the property of the Northern Counties Committee (Ireland) of the Midland Railway (England). The Portpatrick Joint itself is owned by the London and North Western, Midland, Caledonian and Glasgow and South Western Railways.

The South Eastern and Chatham Railway has nothing of a "side line" character in regard to its splendid cross-channel fleet, but it has a side line between Hythe and Sandgate in the form of a horse tramway over three miles long, beside the sea.

As owners of the Trent and Mersey Navigation, the shareholders of the North Staffordshire Railway are in such a large way of business as canal proprietors one cannot fairly describe this particular branch of activity as a "side line." This

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well-known waterway, 119 miles in length was taken over by the railway in 1847, and it is supplied by water from the Rudyard Lake, near Leek, 200 acres in extent. In one feature, however, the North Staffordshire Railway is quite distinctive. The company leases in perpetuity the limestone quarries at Caldon Low. The stone is of an exceedingly fine quality, and in normal times the output is something like half-a-million tons annually, but just now, owing to trade depression, the quantity is, of course, very considerably reduced. The limestone is supplied chiefly to blast furnaces and chemical works. In passing it may be remarked that in things electrical, particularly at Stoke, the North Staffordshire as a steam railway has ever been to the fore for lighting, working machinery, and heating offices, and attention was drawn to this in the RAILWAY MAGAZINE so long ago as February, 1899, when there was also recorded the fact that the North Staffordshire claimed to be the first railway to have water boiled in the refreshment rooms by electricity.

On the North Eastern Railway there is a laundry for the company's hotels and the railway supplies water at many little places along its lines. A distinctive North Eastern feature is that for advertising at the stations, instead of leasing the spaces to advertisement contractors as do most railways, the company has a department that handles this business directly with the advertisers. Among other minor matters the most prominent is that the North Eastern Railway provides the principal link by road between Newcastle and Gateshead—part of the Great North Road—by means of the High Level Bridge, and collects tolls for both foot and vehicular traffic. There are one or two smaller toll bridges on the North Eastern system. In addition to being the largest dock owner among the British railways, the revenue receipts of the North Eastern system are augmented by interest and dividends from investments in other companies. These figures for the year 1921 were :—

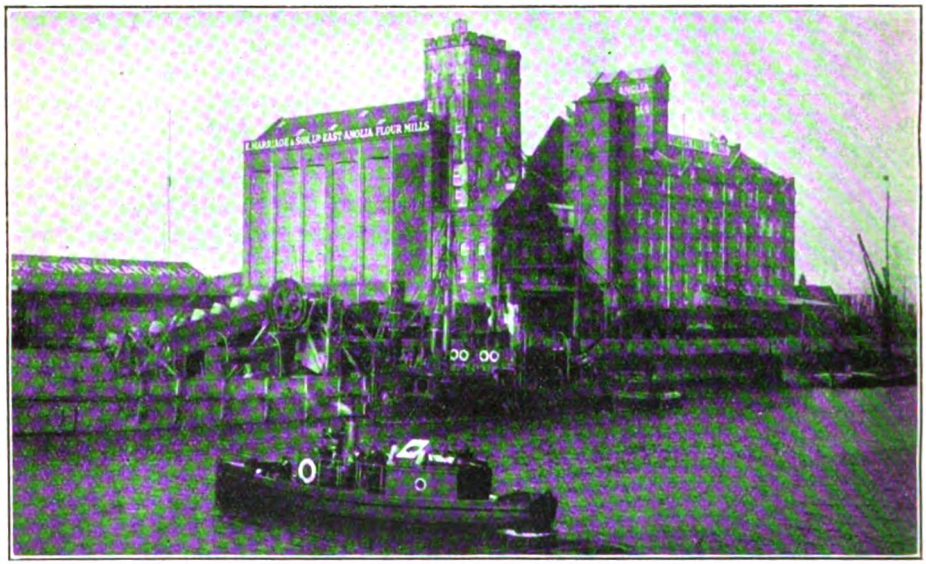

Photo.] [*J. F. Gairns.*

GREAT EASTERN RAILWAY MOTOR BOAT "PIN MILL" LEAVING FELIXSTOWE DOCK.

	£
Cockermouth, Keswick and Penrith Railway	550
Derwent Valley Railway	150
River Wear Commissioners	3,900
Wilson's and North Eastern Railway Shipping Company, Limited	16,500
Hull and Netherlands' Steam Shipping Company	11,628
	£32,728

Not only is the London and North

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Western Railway the "oldest-established firm in the railway passenger business" and further the "biggest joint stock corporation in the world," with enormous revenues derived from the transport of passengers, live stock, merchandise and minerals, but it heads the list of British railways in miscellaneous receipts as well as in gross revenue and expenditure. Therefore it may be expected that this great railway will provide a fruitful field for the observer on the look out for auxiliary activities. All of these may not be directly revenue-earning features but each one is distinctive and more than one is peculiar to the London and North Western system.

For instance at Crewe locomotive works, where about 8,300 men are employed, the London and North Western Railway manufactures the gas for the lighting of the town of Crewe. The water for the same far-famed railway town comes direct from Whitmore where the company's pumping plant is situated. The town of Wolverton too, the location of the carriage works of the company, employing 4,500 hands, is provided by the railway with gas and with practically its entire water supply.

In Crewe works there is a plant by means of which motor spirit is manufactured for the London and North Western Railway's road motor department and ultimate consumption by the company's fleet of motor vehicles.

As doubtless many RAILWAY MAGAZINE readers are aware, practically the entire metal work of the permanent way, such as rails, chairs, &c., is manufactured in Crewe works instead of by outside firms as is the case with many railways. At the Crewe joiners' shop the employees may be found busily engaged in the making of artificial limbs, signal posts, telegraph arms, signal cabins, level crossing gates, portable huts, station name boards, notice boards and many other everyday railway requirements.

In addition to the foregoing activities the London and North Western Railway through its stores department at St. Helens Junction, manufactures carriage wash, wagon axle grease to the extent of 900 to 1,000 tons per annum, about 10,000 railway wagon covers each year, horse clothing and horse rugs—the quantity varying according to requirements, van, lorry, and cartage sheets, roof sheets for the protection of workmen and the public at stations where repairs are being executed, rat poison, about 21 cwt. per annum, bags and sacks of various kinds, rope mats and straw pads for packing purposes to ensure the safe transit of traffic, wagon ropes, cartage ropes and rope slings. At St. Helens Junction also there is carried on the mixing of paint and the mixing of dressing for the waterproofing of wagon covers. Then at Aylesbury there are works where the company makes the various basket-trucks, hampers, &c., required for station and traffic purposes.

A special stores train is run on the London and North Western Railway for delivering supplies to all the stations throughout the system. There are company's piggeries and a railway laundry at Willesden as well as a sanatorium for sick horses. These latter features are recorded not as distinct peculiarities of the "premier" line, but as examples of extraordinary variety, in the adjuncts to the great business of railway transport.

Reference has been made to the public gas lighting supplied by the London and North Western Railway. In a smaller way the Metropolitan Railway trades in electric current from its Neasden Works, for the only firm to which the Metropolitan Railway supplies electricity other than the various tenants of shops and stalls on premises owned by the company, is the Northwood Electric Light & Power Co., Ltd. This company takes current in bulk from the Metropolitan Railway's E.H.T. mains at their Ruislip sub-station and from thence furnishes a supply to the surrounding district. In passing it may be remarked that although the London, Brighton and South Coast Railway does not supply the commodity to the public it lights its own station at Heathfield by natural gas.

A very important "side line" of the Metropolitan Railway is the surplus estate managed by the "Metropolitan Railway Surplus Lands Committee," and the capital and revenue of the estate are dealt with separately from the capital and revenue of the other portions of the Company's undertaking. A further auxiliary is the Metropolitan Railway Country Estates, Limited.

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METROPOLITAN RAILWAY HORSE DELIVERY VANS.

The Metropolitan Railway invariably takes a premier place among the prizewinners at London Van-Horse Parades.

This company sets forth its aims, objects and achievements as follows :—

The Metropolitan Railway Country Estates, Ltd., has provided a means of enabling those wishing to reside in the rural districts served by the Metropolitan Railway to acquire a house, or a site on which to build a house, or to have a house erected to their own designs or requirementr with terms of payment to suit everyone's pocket. The liberality of these terms are thoroughly appreciated by all buyers and the perfected system of payment by instalments adopted by the Estates Co. is assisting a great number of people to acquire their freehold property out of income.

These estates, which are situated respectively five, seven and eighteen miles distant from London, have been carefully selected to serve different classes of residents, and their development during the last two years has been a feature of the property market.

The houses at Kingsbury Garden Village are of the small model type ; those at Chalk Hill are of a somewhat larger class with more ground allotted to them, while the whole of the Cedars Estate is being devoted to detached houses of a small country house type with gardens and paddocks.

A unique opportunity for realising substantial profits by the purchase of sites on these estates presents itself to the wise investor, and calls for careful consideration by all in search of a permanent, safe, and remunerative investment.

No surveyor's charges or legal fees are charged ; the only expense in the latter direction being the cost of stamping documents, fees for registration, and out-of-pocket disbursements. Intending purchasers are conducted to the estate free of railway charges.

As an indication of the Estate Company's confidence of the sterling merits of the estates in question, mention may be made of the fact that the Company have themselves erected some 100 houses, representing a very large capital outlay.

There is another side to railway activity that deserves attention. Railways as we know them in the British Isles really are in fact, if not in theory, something more than mere traders in transport. They possess large staffs and the number of employees of all grades on British railways on March 19, 1921 was 735,870 and on Irish lines, 30,511, making a total of 766,381. To the social, material and even spiritual benefit of the railway staffs in these islands much thought has been given and much action taken by the powers that be. This accounts for the existence of superannuation funds for the officials and the clerical workers, pension funds for the uniform or wages staffs and savings banks for all. There is a great deal of other staff welfare work worthy of record, such as railway missions, temperance societies and so forth that regularly receive the official support of the railway boards.

In towns that owe their origin to the fact that they were made centres of railway industry the efforts made by railway companies for the well-being of their people are, of course, more in evidence than in many others. Crewe, Eastleigh, Horwich,

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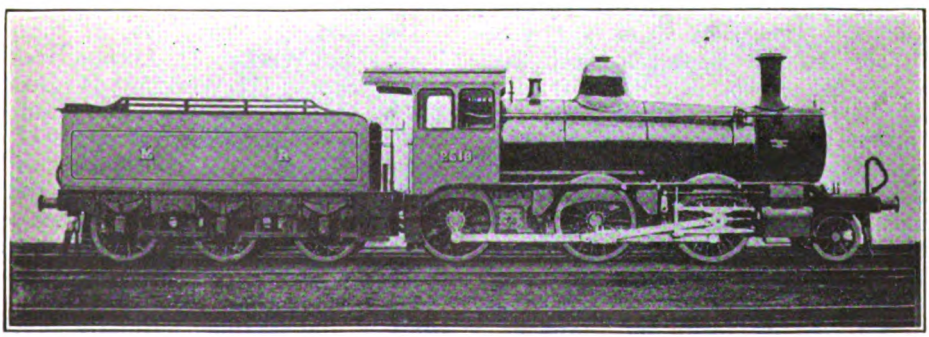
Swindon and Wolverton are places that have risen from insignificance to renown solely by reason of great railway works being established within their boundaries. Other ancient towns or cities such as Derby, Doncaster and York have advanced industrially and so far as population is concerned very much numerically by reason of the railways. That vast hive of industry, Stratford Works, has given to the surrounding neighbourhood of West Ham, Leyton and London - over - the - border generally, a decided railway character. In places such as the fore-named there usually will be found railway mechanics' institutes with valuable libraries, reading rooms and often concert halls and other attractive adjuncts. At Crewe there is a railway park and a cottage hospital, while at Derby there is the famous orphanage under the auspices of the Railway Benevolent Society. It is impossible for the writer to enter into full details of all the methods that have been adopted in Great Britain for meeting the social necessities of the people employed in the railway industry, but a few examples may be cited. Thus at Doncaster, St. James's Church was built with money subscribed by Great Northern Railway shareholders and the London and North Western Railway has subscribed liberally towards the provision of places of worship in the railway towns the company dominates. Newer companies, too, such as the London Underground Electric, are not behind the older ones in respect to staff welfare. In fact, in many ways they have taken the lead, particularly in the provision of clubs and dining rooms for lady clerks and female workers generally.

A passing reference may be made to the Glasgow & South Western Railway's model village at Corkerill. In this well-regulated little township the religious as well as the material side of life is not neglected in the arrangements made by the railway company for the well-being of the inhabitants.

Further evidence of the interest taken in the humanities is provided by the active support given to railway athletic, dramatic and musical societies. Without making invidious distinctions mention may be made of the London & North Western and of the Great Western Railways, while in regard to its musical society the Great Eastern Railway possesses a particularly prominent position.

Consideration of space forbids the further extension of this gossip on railway "side lines," but enough has been said to demonstrate that just as surely as man does not live by bread alone, neither does a British railway confine its activity to its recognised *raison d'être*, the provision of public transport, nor to the attributes of the common carrier, however excellent and necessary to the community at large may be the obvious and prevailing characteristics of our great railway systems.

AMERICAN-BUILT 2-6-0 LOCOMOTIVE, MIDLAND RAILWAY (1899).



All such engines, purchased by the Midland, Great Northern & Great Central Railways, have been broken up.

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The International Railway Congress at Rome.

By OUR SPECIAL COMMISSIONERS.

THE ninth Congress of the International Railway Association opened in Rome on April 18. It would be impossible within the limits of available space to deal at any great length with the Congress proceedings and the work of the five sections, but the following brief summary will at least suffice to give a general indication of the more important points of interest in connection with the Congress.

Tuesday morning, April 18, was set apart for the reception of the delegates by the Permanent Commission of the International Railway Association and the registration of the members of the ninth Congress at the Fine Arts Exhibition building. There some 836 delegates registered as members of the ninth Congress, and each received the special badge of a delegate, and, on applying at the bureau, was given his group of papers. At 3 p.m. the same day the Congress was formally opened. His Majesty Victor Emanuel III, King of Italy, honouring the Congress with his presence. Some 1,300 delegates and relatives were present. The proceedings were relatively brief. His Excellency Signor Riccio, Italian Minister of Public Works, who was charged by the Government to extend an official welcome to the delegates, occupied the centre place on the platform, and had on his right, M. Tondelier, President of the Permanent Commission, M. Gerard, Vice-President, and M. Verdeyen, Secretary-General. On Signor Riccio's left were Signor Crova, General Manager of the Italian State Railways, and M. Colson, Vice-President of the Permanent Commission. The remaining members of the Permanent Commission and the principal representatives of the various Governments were on the platform. His Majesty, the King of Italy occupied the State chair, in the centre, facing the platform.

The opening ceremony took place in a large glass-roofed hall at the Fine Arts Exhibition building. The hall was tastefully decorated with the flags of the various nations represented at the Congress, and it was there that the general meetings of the delegates were held. An address of welcome was delivered by Signor Riccio, responses being made by M. Tondelier and Signor Crova. His Majesty the King of Italy and His Excellency Signor Riccio, Minister of Public Works, then left the meeting, and M. Tondelier proposed that Signor Riccio should be appointed Honorary President and Signor Crova Acting-President of the Congress. The latter then gave an address in which he summarised many interesting facts in regard to the Italian railways and their development under State management.

M. Verdeyen made a brief speech in reply, and the proceedings terminated, when, on the initiative of M. Tondelier, a large number of the delegates proceeded to the Piazza Venezia, where a wreath was placed on the tomb of Italy's unknown soldier. The tomb is placed at the foot of the statue of the Italian King who was the founder of Italian unity.

On Wednesday, April 20, the five sections were formed, and the delegates settled down to the consideration of the several important questions tabulated for discussion. There were one or two sessions held each day up to April 27, while on April 28 the delegates assembled in general meeting for the final discussion on the conclusions and the formal closing of the debates.

The sections were five in number: I. Way and Works; II. Locomotives and Rolling-Stock; III. Working; IV. General; and V. Light Railways. Twenty subjects have been discussed, the basis of the discussion being the conclusions of the special reporters appointed to review the various reports submitted on each subject. The rooms in which the sectional meetings were held were ranged round a huge circular entrance hall. The work of the sections naturally proceeds somewhat slowly owing to the necessity for interpreting the views advanced, but real progress was made towards a solution of the various problems.

On April 19 the Italian Government

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gave a banquet to the delegates. This was held in the Terme Diocleziane, which was specially prepared for the occasion. The lighting was provided by means of 300 batteries of accumulators, giving 45,000 candle-power, and it is of interest to note that the tables were laid in the old Roman style, the electric lights being in candlesticks moulded specially for the occasion. Covers were laid for 1,300 guests. There were 46 tables, 200 waiters and 24 cooks, while the equipment provided included 10,000 plates, 7,000 glasses and 20,000 pieces of cutlery. The Rome papers devoted considerable space to a description of the banquet and gave statistics to indicate the amount of food of each kind provided. An appropriate note was given to the banquet by the serving of one of the courses from model locomotives, some 3 ft. long and 12 in. high, designed on the lines of the Italian State Railway locomotives. This innovation was highly appreciated by those present, and at the conclusion of the banquet the model locomotives, of which about 500 were supplied, were distributed to the guests.

On April 20 there was no afternoon meeting of the sections as, at 5.30 p.m. that day the delegates were invited to a reception at the Capitol. The following day, April 21, after the morning meeting of the sections, there were two items on the programme. One was a visit to the monuments of ancient Rome and the other a visit to the Rome (St. Lorenzo) locomotive depôt. About 500 delegates, conveyed in motor cars, took No. 1, and a large number travelled by special train to St. Lorenzo, where they inspected an engine turntable worked from the Westinghouse brake reservoir on the engine, a special system for washing out boilers and the Caprotti valve gear.

Two special trains were placed at the disposal of the delegates on April 22 for a visit to Terni. Each of the trains comprised 14 first-class corridor cars, and was drawn by two engines. A word of special commendation may be added as to the pleasing appearance of the stock provided. If it did not surpass the best to be found in other countries it was certainly equal to anything we have seen. The journey of a little over two hours in each direction was a most comfortable one and was made smartly on time. At Terni the delegates were conveyed in electric trains over the Central Umbrian lines to the large hydro-electric establishment, and the calcium carbide works at both of which places there was much of interest to be seen.

Sunday was set apart for a day of rest, but in the evening a lantern lecture was given by Comm. Vito Margotta on "The Construction of Railways in Italy Since the Origin of the Kingdom." The delegates returned to their deliberations on Monday, April 24, when each of the five sections continued its discussions on the outstanding questions. In the afternoon a visit of inspection was paid to the Test Institute at Rome of the Italian State Railways. Sectional discussions occupied the major portion of the following day, and on Wednesday, April 26, after sectional business in the morning, the first general meeting of the delegates was held to consider the sectional conclusions. This was a somewhat formal business, as while the conclusions could be amended at this general meeting, in practice the business consisted of the formal adoption of the sectional conclusions by the International Railway Association. The conclusions were read in French—the official language of the Congress—in Italian, because the Congress was held in Italy, and in English, and were accepted. The formal closing of the session at Rome took place on April 28, and subsequently the delegates travelled to Naples in three special trains provided by the courtesy of the Italian State Railways Administration.

The Congress was concluded at Genoa, whither the delegates arrived by sea from Naples on May 2. The final function was a reception on board the ss. *Jules Cæsar*.

Apart altogether from the sectional discussions on pressing railway problems, the opportunity afforded by the Congress for railwaymen from all parts of the world to "get together" is of the utmost value. It is probable, states our special commissioner, that as much good work is done outside the doors of the Congress Hall as that performed therein, and the exchange of expert views on railway problems other than those down for discussion will certainly help towards a solution of difficult questions.

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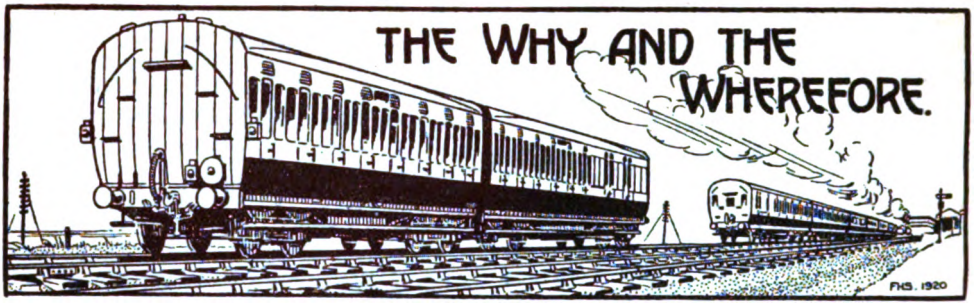

RAILWAY MAGAZINE *readers desiring information should mark envelopes "Query" in the upper left-hand corner, and address them to the Editor. Questions relating to the dimensions and weights of railway rolling-stock and to names, numbers, dates, etc., of locomotives should not be forwarded. No reader should send more than two questions in one month. Correspondents are requested to write on one side of the paper only, and although they must give their names and addresses, pen-names or initials may be inserted for Editorial use. Before asking for information concerning railway history and the like, the pages of the "Railway Year Book" should be consulted. The twenty-fifth Annual Edition of this standard railway reference work is on sale at 5s. net, or by post, from the* RAILWAY MAGAZINE *Offices, 33, Tothill Street, Westminster, London, S.W.1, to any part of the world, 5s. 9d.*

Woodford Junction, Great Central Railway.

With further reference to the reply given in the April RAILWAY MAGAZINE, Mr. W. E. Callam writes: "This line was, I believe, originally planned out with the idea of the Great Central running trains from their own line over the South Junction to the West, then over the East and West Junction (now Stratford-upon-Avon and Midland Junction) Railway to Stratford-on-Avon, and from there over the 'Birmingham, North Warwickshire and Stratford-on-Avon Railway' to an independent station in Birmingham. The junction and line were certainly made, the length, included in the contract, being 60 chains. The line started from Woodford North Junction, and extended to the point where the Great Central crosses the London and North Western Railway below Brackley, and the contract included also the Banbury branch. This contract (No. 5) was let to Messrs. Walter Scott & Co., and one of their chief troubles was the Brackley viaduct, the three southern arches giving way and two of them having to be rebuilt as a girder structure. When I last saw the South Junction, the points had been taken out for a few yards and blocks of timbers erected, thus converting the line into a siding at the West Junction, and it was fairly full of trucks at the time. Just near here is one of the old Roman roads; in fact, I think the entrance to Woodford station is in it."

[Reply to R. KIRBY.]

"Cosmopolitan" Railway Stations.

In the United Kingdom, the largest number of railway companies using one station is seven, this occurring at Carlisle, where both trains and engines of the London and North Western, Midland, North Eastern, Maryport and Carlisle, Caledonian, North British, and Glasgow and South Western Railways, are all to be seen. At York there are five railways, North Eastern, Great Northern, Midland, Great Central, and Great Eastern. while engines and rolling-stock of the Lancashire and Yorkshire section of the London and North Western Railway, and carriages, but not engines, of the original London and North Western Railway are to be seen. We cannot state if there are more than seven railways to be seen at some of the big Continental centres of international traffic, or at the American "Union" stations.

[Reply to T. W. LINSELL.]

Through Carriages, Midland Railway.

Presumably, the Great Western, Lancashire and Yorkshire, and Somerset and Dorset Joint Railway vehicles, which you have seen on Midland trains at Derby station, are those used for through carriages to places on the respective systems. In many cases through carriage arrangements are served on alternate days by stock of each of the railways concerned. In other cases the through carriages are always of one company. It is not unusual, too, for vehicles belonging to a foreign railway to work through for special purposes. In

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the case of the three railways noted, these are all associated, we believe, with regular through carriage arrangements.

[Reply to A. C. S.]

A Comparison of Continental Routes.

We should be inclined to consider the Great Eastern route from Liverpool Street to Parkeston Quay considerably harder from the point of view of grading than the South Eastern and Chatham main line from London to Folkestone; the former also has many more service slacks en route than the latter. To work such an express as the 8.30 p.m. from Liverpool Street to Parkeston in the schedule time of 82 min. involves more onerous locomotive work, taking load into account, than any South Eastern and Chatham Railway schedule with which we are acquainted, though allowing for the smaller engines used in the latter case the work done is probably of equal excellence.

[Reply to P. D. MORRIS.]

4-6-2 Locomotives.

As you will have seen from the May RAILWAY MAGAZINE, and as fully described in the present number, the Great Northern Railway has now adopted 4-6-2 locomotives, and the Great Western Railway engine No. 111, *The Great Bear*, is no longer the sole representative of this type. The 4-6-2 wheel arrangement has not been adopted so far, mainly because it has been possible to conduct traffic with engines of the 4-4-2 and 4-6-0 types. The need for increased power is, however, gradually necessitating still larger engines.

[Reply to J. E. MORDEY and W. LENDON.]

4-6-0 Goods Locomotives, Great Western Railway.

The engine you mention, No. 2601, was built as a 4-6-0 inside cylinder goods locomotive, but was very similar to 2602, which, we believe, initiated the 2-6-0 goods or mineral class. There was also another 4-6-0 engine, No. 36, built by Mr. Dean before No. 2601. The latter is, we believe, still in existence, though it has long since been converted to the 2-6-0 type. We are not certain if No. 36 was similarly dealt with. Your congratulatory remarks concerning the RAILWAY MAGAZINE are much appreciated.

[Reply to H.G.C.]

Great Western Railway Locomotives.

Some years ago many locomotives were renumbered in order to bring engines of the same classes together, and that, no doubt, explains why No. 3374 is now 4121. The fact that this engine was, about 1914, used for working a Royal train, and then bore the name *Britannia* is explained by the favourite Great Western Railway practice of temporarily transferring nameplates, so that engines selected for special duties are appropriately named.

[Reply to "DARTMOOR."]

Junctions at Savernake.

Supplementing the information already given, Mr. H. H. Meik mentions that "formerly the Midland and South Western Junction Railway, ran over the Great Western Railway branch line from Savernake to Marlborough, so there must have been at one time a 'physical connection' at Marlborough. I always understood that the Midland and South Western Junction Railway used the Great Western Railway line until they constructed their own line from Marlborough to Grafton."

[Reply to G. N. SOUTHERDEN.]

Loughton and Ongar Branch, Great Eastern Railway.

The gradient diagram reproduced with our article on the Loughton and Ongar Branch, published in the RAILWAY MAGAZINE for September, 1920, could not include every little detail. The gradients, as quoted by you, between Theydon Bois and Epping would, however, average out at about 1 in 78 as given, the individual changes of gradient being much too frequent to be shown, except on a large scale diagram.

[Reply to H. A. POPER.]

Gradients, Liverpool Street-Chingford.

Principal grades are $\frac{3}{8}$-mile at 1 in 70 up to Bethnal Green West Junction, with a further $\frac{3}{8}$ up at 1 in 122 between there and Cambridge Heath; $\frac{1}{4}$-mile down at 1 in 75 to Hackney Downs Tunnel; $1\frac{3}{4}$ miles up, mostly at 1 in 80-136, from near St. James' Street to Wood Street; $\frac{1}{2}$-mile down at 1 in 114-165 between Wood Street and Higham's Park; and a final $1\frac{3}{8}$ miles up at 1 in 109-80 from Higham's Park to Chingford.

[Reply to P. D. MORRIS.]

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The First Engine Driver.

Presumably Richard Trevithick, who is generally regarded as "the father of the locomotive," was the first who could be described as a "locomotive engine driver," as, no doubt, he acted as driver during the initial trials, if not afterwards. This was necessarily some years before George Stephenson commenced the design and construction, and, in due course, driving of locomotive engines.

[Reply to "STAFFORD ROAD."]

South Eastern and Chatham Railway Locomotive Working.

A number of suburban traffic duties are given to main-line engines in the London district, and that would account for large 4-4-0 main-line locomotives operating on routes such as the Mid-Kent. This is done, apparently, to enable suitable duties to be arranged, and to meet the need for additional engines during the morning and evening pressure periods of the suburban traffic.

[Reply to F. D. LYS.]

Birmingham to Liverpool.

Distance by the shortest route between Birmingham and Lime Street station, Liverpool, is 95 miles, 25 chains, viz., *via* Warrington, and consequently, the London and North Western Railway is not charging up to its full powers. The distance *via* Runcorn is 97 miles 14 chains, this including the extra allowance for Runcorn Bridge. Present-day single fare is 13s. 4d.

[Reply to "NORTHERNER."]

West London Railway and West London Extension.

In addition to the local passenger services of the London, Brighton and South Coast and London and South Western Railways to and from Addison Road, and the London and North Western and Joint Great Western and Metropolitan Railways electric services, the London, Brighton and South Coast "Sunny South Special" *en route* from Willesden Junction to Brighton and Eastbourne, passes over this route.

[Reply to G. R. SOUTHERDEN.]

Wood in Rolling-stock Construction.

Mr. Webb, on the London and North Western Railway, used wood freely for tender frames, buffer-beams and brake-blocks, and numbers of engines so equipped are still in service on that railway. Wood was also used to a large extent at one time for carriage frames (as distinct from the bodies), wheel centres, &c., but is now entirely displaced by steel in new constructions.

[Reply to "SECOND CITY."]

Norton-Fitzwarren Accident.

A down goods train had been placed on the up line to allow a down night mail train from London to pass it. The former was forgotten by the signalman, who allowed an up special train from Plymouth to London to approach. Your remarks are thus in accordance with the facts, whereas the previous reply was open to misconception.

[Reply to D. D. ROWLANDS.]

London and North Western Railway Locomotive Splashers.

A square splasher to the rear pair of driving wheels has been a standard feature of London and North Western Railway tender engines for many years past. It has no particular virtue, other than that of housing certain details as well as the coupled wheels, and that of appearance. Your "comparison" query was answered recently in these columns.

[Reply to H. S. HACK.]

Engines in Railway Accidents.

We are frequently asked for the number (and name, if any) of engines concerned in railway accidents. Unless mentioned in newspaper accounts, information of this character cannot be given except following special enquiry, which is rarely justified, and such queries cannot be answered in future.

[Reply to J. W. CUNNINGHAM and others.]

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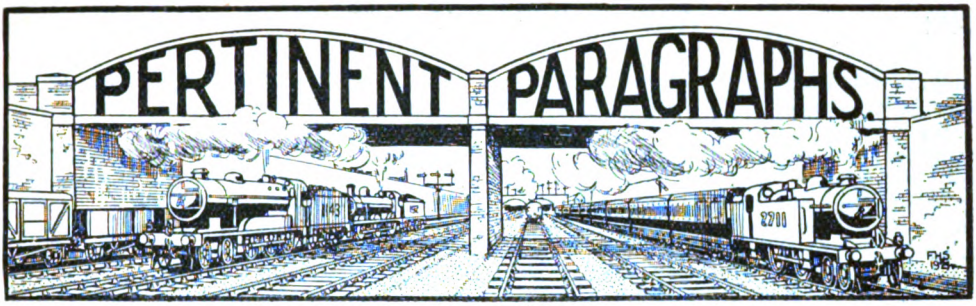

Train Service Improvements.

It is too soon yet to anticipate the full scope of the train service improvements which the coming summer is to produce, but indications so far available suggest that there will be many developments of an interesting and valuable character. Time-tables dated for May and until the summer season traffic is inaugurated—in the case of the Midland Railway they are to apply until October 1 and include the summer additions—have been issued by several companies, and a number of important accelerations and new facilities are foreshadowed. Commencing June 12, the London and North Western and South Eastern and Chatham Railways will provide a through service between Liverpool, Manchester, Birmingham and stations to Ramsgate Harbour on the Kent Coast section of the latter system, thus restoring a through facility which was much valued in pre-war days. Restaurant car facilities will be available. The route will be via Addison Road, Kensington. The through Kent Coast service from and to the Great Western Railway via Reading is also, we understand, to be restored. In May the West Coast sleeping car express for Glasgow was altered to leave Euston at 11.40 p.m. instead of 11.15 p.m., while the 2.10 p.m. express from London to Birmingham was given a stop at Coventry within the two-hour schedule. Incidentally, one time-table is now issued for both sections of the London and North Western Railway, under the joint names of Mr. L. W. Horne, and Mr. Ashton Davies, the southern and northern divisional general superintendents respectively. Midland Railway arrangements include accelerated and additional Anglo-Scottish facilities, and a new train from St. Pancras at 11.50 a.m. for Edinburgh (southbound from Edinburgh at 10.35 a.m.), another four-hour train between London and Manchester, together with many additional altered and accelerated trains on all sections.

A 20 ft. Gauge Super-Railway.

A Mr. David Barratt has recently issued to the press generally, though we have not observed its publication anywhere, a review of his scheme for a joint British-French broad-gauge super-railway, which includes features which are, to put it mildly, somewhat startling. He commences quite reasonably by pointing out that Great Britain is unfortunate in regard to railway development, owing to the fact that we were the pioneers, and, after having introduced railways to the world, we are now the most restricted amongst the great nations. In his comparisons between our "toy trains" and American practice he is, however, somewhat at fault, in that the track gauge is the same in the United States as here, though their engines and rolling-stock extend much higher, are wider and of much greater size and weight than here, and yet no one would ever suggest that from that cause they are more liable to "topple over at speed on any bend" than in the case of our own railways.

Wanted—a "Big Man."

Mr. Barratt then suggests that what is wanted now is "a big man," or, as he puts it, a "second Stephenson to give us the super-railway," and in this connection he argues that the super-railway and the Channel Tunnel should go together as one big undertaking. The Channel Tunnel must not, however, be built to accommodate only our "toy trains," and this is where he begins to "let himself go," apparently to set forth his qualifications as the "big man" required. He asks "Why not a 20-ft. gauge?. The rails would probably have to be twice as heavy and possibly four times as strong as those in use at present. All bridges, platforms and tunnels would have to be constructed on the same big scale. Now for the trains. The engines would be veritable monsters. Probably still steam-driven but oil-fired. Possibly even turbines. Driving wheels 20 ft. in diameter. Weight from 500 to a 1,000 tons. Capable of hauling the trains at least twice as fast as our modern expresses. A hundred and twenty miles an hour—and in perfect safety. Everything would be in proportion. The coaches would be of such a size that the interior would resemble a saloon in a modern liner. No longer would passengers be cooped in rows on narrow seats in small compartments, but would be free to move about. Just as

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a liner is sometimes spoken of as a 'Floating Hotel,' so this could be a 'Travelling Hotel.'"

Having thus set forth his ideas, which certainly do not lack boldness, he rather spoils the scheme by confining it to connections between London and Paris, from London to the North of England and Scotland, and from Calais to Belgium and other parts of Europe, without suggesting that it might eventually extend from London to, say, Peking or Calcutta, or even to Cape Town via a tunnel under the Straits of Gibraltar. Mr. Barratt admits that a gigantic project such as this would naturally require an enormous expenditure of capital, though he supports his anticipations that it could be raised by an entirely false analogy, that although during the Great War thousands of millions of pounds went to waste, "yet, during that period, this country, in common with other countries, enjoyed such prosperity as had never been experienced within the memory of living man." He considers, however, that the constructional work involved would justify the capital required, and that those who financed the scheme would have so valuable an asset that it would pay handsomely.

There is no need to deal further with the scheme except to point out that a double-track Channel Tunnel for a 20-ft. gauge railway would require a diameter of about 80 ft., and there would be lamentable waste of space if the trains were to be, say, 30 ft. wide and only 15 or 16 ft. high. In other words, Mr. Barratt has lost an opportunity of suggesting double-storey trains.

London Congress, Institute of Transport, May 17 to 20, 1922.

A CONGRESS of the Institute was held in London on May 17, 18, 19 and 20. The proceedings comprised the reading and discussion of papers at meetings held on the mornings of the three first days at the Institution of Civil Engineers, Great George Street, Westminster, S.W., where accommodation was courteously provided by the Council of that Institution. A lecture for graduates and students was delivered at the rooms of the Royal Society of Arts, John Street, Adelphi, W.C.2, at 5 p.m. on May 19. The afternoons of these three days and the Saturday following were devoted to visits and inspections. The Rt. Hon. the Lord Mayor of London (Alderman Sir John J. Baddeley) entertained the delegates to a conversazione at the Mansion House, on the evening of May 17, and the third dinner of the Institute was held on the following evening.

We hope to deal with these functions and with the Congress as a whole next month, but meanwhile the following papers and visits may be mentioned as of principal interest to railway readers: (1) *Papers*—"Foreign Railway Practice," by Professor J. Carlier; "'Safety' in Railway Operation," by Colonel J. W. Pringle, C.B.; "The Operation of Heavy Suburban Passenger Services on a Steam Railway, with particular Reference to Density of Service, Terminal and other Facilities," by Mr. F. V. Russell, C.B.E.; *Visits*—Somers Town goods depôt, Midland Railway; Neasden power station, Metropolitan Railway; Lots Road power station and the Chiswick overhaul depôt, "Underground" Railways, &c.; Waterloo station, Feltham marshalling yard and Wimbledon power house, London and South Western Railway; Reading signal works, Great Western Railway; Euston Station and Stonebridge Park power station, London and North Western Railway; a demonstration of the application of pulverised coal and colloidal fuel to locomotive engines at Marylebone station, Great Central Railway; and, an unusual feature of a valuable character, a visit to Liverpool Street station, Great Eastern Railway, to witness early morning suburban traffic operation.

The "James Forrest" Lecture by Sir John Aspinall.

SIR JOHN ASPINALL, in his "James Forrest" lecture to the Institute of Civil Engineers, on Tuesday, May 2, discoursed upon a wide rage of topics, from tube railways to helicopter air mail-packets. He is anxious to see co-ordinated effort directed to the solution of London traffic problems, and suggests that possibly even now Waterloo station might be made the point of departure and arrival of the Continental services of the three southern systems if the electric trains could be accommodated elsewhere. Upon all railway questions, especially those concerned with electric traction, Sir John's experience lends unusual interest and authority to his views, and he is strongly in favour of more rapid progress in this country with electrification, not only of suburban railways, but also of main line traffic, of which there were numerous instances, if the district be carefully selected, where expenditure under this head would be found immediately very remunerative, especially for goods traffic. He looks to the development of trackless trolley road-motor services for goods as a concomitant of improved electric power distribution, and while recognising the legitimate position of the railways in regard to road traffic, suggests that in some cases a remission of local taxation might prove more profitable than any net increase obtainable from road haulage. Apart from economies to be derived from standardisation of locomotives and wagons, from improvement of

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wagon-loading and decrease of shunting, Sir John considers that the largest saving could be effected by improvements in the carriage and handling at shipment ports of export bunker and coastwise coal. Advocating the more rapid equipment of goods wagons with continuous brakes, he dealt, in conclusion, with the question of barge-canals, whose day in this country he considers is past, and with the future of aerial transport.

Improvements at Victoria Station, South-Eastern and Chatham Railway.

THE South Eastern and Chatham Railway's Managing Committee made a valuable addition to the station accommodation at Victoria by materially widening the main line arrival platform, No. 1, which runs parallel with the boundary wall of the adjoining London, Brighton and South Coast Railway station. Acting upon the advice of Mr. P. C. Tempest, the General Manager of the South Eastern and Chatham system, the Committee have recently determined to effect a corresponding improvement by demolishing the original Nos. 3 and 4 platforms, and, in their stead, building a much longer and more substantial structure as a central island platform, to serve the purposes of both incoming and outgoing traffic. The latter work was entered upon shortly after Easter, and it is hoped that it may be completed in time to be available for the first time in connection with the coming Whitsuntide holidays.

Since it became necessary to concentrate the majority of the Continental services at Victoria, thereby involving the daily movement of a largely increased number of trains, and the consequent need for the longest platform space available within the station precincts—which, unfortunately, do not permit of outer extension in any direction—the facilities for dealing with the requirements of growing main line traffic have been seriously curtailed, with the result that the operative staff have been unduly handicapped. Notwithstanding these difficulties, the dispatch and arrival of trains has continued with a degree of regularity that has obtained for those responsible in the management a position highly creditable in the record of railway administration.

But the experience at Easter this year convinced the directors as to the urgent necessity of the alterations that are now in active progress, whereby a new and wide island platform is to replace the old Nos. 3 and 4 platforms. While the separate platforms, Nos. 3 and 4, were respectively only 380 ft. and 410 ft. long, with a breadth not exceeding 12 ft. at any point, the new central island platform, absorbing both, is to possess a total length of 550 ft., with a uniform width of 37 ft., the enlarged area having been acquired by the abolition of the intermediate line which divided them.

This reconstruction of the platforms will obviously be of immense assistance to the staff, in enabling them the more effectually to cope with the long and heavily-laden trains which, particularly throughout the summer months, are daily running to and from the many resorts on the Kent coast, all steadily becoming more and more popular. In future this coast and kindred traffic will, in all normal circumstances—as also, it may be hoped, in times of greatest pressure—be conducted quite separately from the Continental traffic, to which, on outgoing journeys, platforms Nos. 8, 9 and 10 will, as hitherto, be devoted, while incoming trains from Dover and Folkestone will discharge at platforms Nos. 1 and 2.

All-Electric Automatic Power Signalling on the Metropolitan Railway.

IN the course of a paper read recently before the Institution of Civil Engineers by Mr. William Willox, M.A., M.Inst.C.E., late Chief Engineer of the Metropolitan Railway, a number of interesting points in regard to the introduction of automatic signalling on the Metropolitan Railway and other subsequent developments. When electric trains began to run on the Metropolitan Railway in 1905, the system of signalling was mechanical, controlled by Spagnoletti lock-and-block. The number of trains between Praed Street Junction and Aldgate—about 5 miles—was then 621 per day on both roads, and the number of signal sections was 49. As the trains increased in number it was found necessary to introduce automatic signalling controlled by track circuits. The system chosen was all-electric, and the work was begun in 1908. This section was completed in 1909. Two power frames were installed to deal with the traffic at these places, but the existing mechanical boxes at the intervening stations were retained for shunting purposes with the addition of the safeguards afforded by track control. The number of trains in 1913 at Praed Street Junction was 863, and from Baker Street to Aldgate 983, and the number of signal sections 91.

There are about 20 hours daily of continuous passenger traffic, but between the hours of 7.30 and 10 a.m. and 4.30 to 7.30 p.m. the traffic is so dense as to necessitate 40 booked trains each way to and from the City per hour, and the automatic signalling deals with these successfully. Similar signalling was installed between Baker Street and Neasden in 1911, the number of signalling sections being increased from 24 to 51. At this date there was only one through line at Baker Street dealt with by two

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signal-boxes, one at the north end of the station and one at the Circle end. This through line was track circuited, and full protection was afforded to train movements, allowing 48 through passenger trains to run to and from the City daily.

Developments at Baker Street.

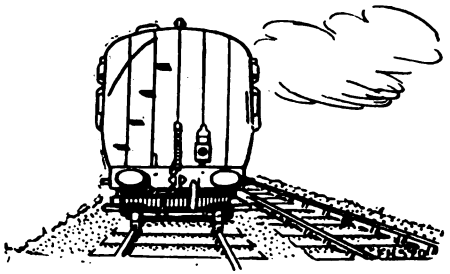
In 1913 the new Baker Street station was completed. Automatic signalling was then installed between the Circle lines and the north end of the station. For this purpose a small signal-box was constructed on a retaining wall so as to be out of the way, and in it a power frame of 36 levers (six spare) was installed. This power frame deals with over 1,500 trains a day, and it is interesting to note that the signalman has no view of the trains except those within station limits immediately in front of his box. Through the station all signals and points are controlled by D.C., but the track circuits are A.C. In 1913 also two new fast lines were constructed alongside the old or local lines from Finchley Road to Wembley Park, a distance of 5 miles. Through the junction at Finchley Road and on to Wembley Park A.C. track circuits were installed, but the signals are worked by D.C. as far as Neasden power house. From this point to Harrow-on-the-Hill, A.C. is used for the signals as well as for the tracks, and from the same point A.C. is used both for the tracks and signals on the local lines to the junction north of Wembley Park Station, where the fast and local lines converge. From Baker Street to Harrow-on-the-Hill, before automatic signalling, there were 39 signalling sections; now there are 69, and on the through fast lines there are 20 sections.

Praed Street-South Kensington Section.

In 1919 the signalling from Praed Street station to South Kensington, which was an automatic bar-and-treadle system controlled by D.C., was track circuited with A.C., but the signals continue to be controlled by D.C. Current for the supply of power to operate the power frame at Praed Street Junction and at Baker Street is obtained from two 130-volt, 5 kw. motor generators through suitable cables. These supply power for the operation of the points, the signal lamps and train stops, the electro-magnets for back locks and for the constant indication of power-worked points at Praed Street Junction, and also for working the power frame at Baker Street. For operating the track circuits, automatic and semi-automatic signals, and various train stops, and for the four large illuminated train indicators at Baker Street, power is obtained from one 15 and two 12-kw., 70-volt motor-generators in Baker Street sub-station, and the maximum power taken is 14 kw. The mechanical locking in the power frames is ordinary miniature tappet-locking controlled by levers in the ordinary way, the electric locking frame being behind the levers. Illuminated continuous diagrams are placed behind the frames lighted by 75-volt, 5 candle-power lamps.

Between junctions it is possible to have a number of trains, *e.g.*, 10 between Finchley Road and Baker Street, and Westinghouse Brake and Saxby Signal Company's magazine train-describers were installed, by which the signalman at Finchley Road is enabled to indicate to the Baker Street signalman whether the train terminates there, or is a through train to the City. All points where there are power frames are worked by the Westinghouse Brake and Saxby Signal Company's all-electric point machines. These machines are very successful in operation.

Cost of maintenance is not excessive. Before automatic signalling was installed there were 645 levers in use, whereas at present only 311 levers are employed, while the number of signalmen was reduced from 86 to 27. This meant, in 1908, a saving of £127 per week in signalmen's wages, which at the present date would amount approximately to £325 per week. During 1920 the whole cost of maintenance—wages and materials—of the signalling of the electrified lines amounted to £123 per route-mile. Charts have been kept from the commencement of automatic signalling in order to ascertain the number of delays to trains as compared with delays with ordinary signalling, and the comparison comes out very favourably to automatic signalling.



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MR. ERNEST A. PROSSER, C.B.E., who has resigned from the position of General Manager, Cardiff Railway and Docks, Rhymney Railway and Taff Vale Railway, in consequence of the amalgamation of those companies with the Great Western Railway, is a native of Cardiff. In 1881 he secured a junior clerkship on the Rhymney Railway. Thereafter Mr. Prosser went through all departments, and obtained a practical acquaintance with goods management and traffic superintendence, combined with a general knowledge of engineering. He became General Manager in 1905, and in April, 1917, General Manager of the Cardiff Railway (owners of the Bute Docks at Cardiff) in conjunction with his position as General Manager of the Rhymney Railway. Then, in July, 1917, he was given the additional appointment of General Manager of the Taff Vale Railway.

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MR. HENRY JACKSON, M.I.E.E., has retired from his position with the London and North Western Railway having reached the age limit. He was Telegraph Superintendent and Electrical Engineer to the Lancashire and Yorkshire Railway for a period of 32½ years and was transferred to the North Western when the amalgamation took place. He commenced his career with Messrs. Tyer and Co. in 1877 and in 1884 was appointed Electrical Engineer to the Furness Railway. In those early days, in addition to railway telegraphs, he had considerable experience in electric lighting of docks, petroleum storage and ship lighting. In 1889 he was appointed to the position on the Lancashire and Yorkshire railway which he has just resigned. He was chairman of the Railway Electrical and Telegraph Engineers' Conference in 1899 and again in 1915 for the duration of the war. Recently the Railway Electrical and Telegraph Engineers and a few personal friends entertained Mr. Jackson to dinner at Euston Hotel, London, and presented him with an easy chair and a silver tray suitably inscribed. Mr. Russell of the Glasgow and South Western Railway presided and spoke in high terms of Mr. Jackson's abilities and his readiness at all times to assist and give advice to his colleagues and wished him all happiness in his retirement. Mr. Fleming of the Furness Railway spoke in high terms of his old chief under whom he served between 1878 and 1889 and pointed out that Mr. Jackson was one of the pioneers in electric lighting, having lighted Ramsden Docks, Barrow with three separate Siemens dynamos, supplying current to three arc lamps on the top of 86 ft. lattice iron standards.

Mr. E. A. PROSSER,

General Manager,
Rhymney Railway, 1905-1922,
Cardiff and Taff Vale Railways, 1917-1922.

* * *

OWING to the appointment of Mr. T. A. Kenyon, M.B.E., as Assistant to the General Manager of the new London and North Western Railway, which necessitates him leaving Lancashire and taking up office at Euston, he has been reluctantly compelled to resign his office as Hon. Secretary of the North Western Local Section of the Institute of Transport. At a meeting of the Local Section Committee Mr. David Halliwell, M.B.E., Assistant to General Superintendent

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(Northern Division) L. & N. W. Railway, Manchester, was unanimously appointed as Hon. Secretary in succession to Mr. Kenyon.

* * *

MR. J. A. MILLIGAN, M.B.E., the new Commercial Assistant to the Divisional General Superintendent (Southern Division), London and North Western Railway, has had a wide experience. He entered the service at Whitehaven in 1887, and was transferred to the Stationmaster's Office at Coventry in 1897, where he remained until 1900, when he joined the staff of the District Superintendent at Birmingham, filling positions in the Timetable, Excursion and other sections. In 1908 Mr. Milligan was removed to London, and since that date has occupied various posts in the Superintendent of the Line's Office. He is the Secretary for the London and North Western Railway (Section A) St. John Ambulance Centre.

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MR. W. E. BRADBURY, M.B.E., has been placed in charge of the Publicity Section of the General Superintendent's (Southern Division) Department, London and North Western Railway, at Euston. Mr. Bradbury began his railway career on the Great Northern Railway, and went to the London and North Western Railway on January 1, 1878, as Telegraph Clerk at Chalk Farm, since when he has been :—March 1, 1879, removed to Telegraph Office, Euston ; January 1, 1888, transferred to District Superintendent's Office, Euston ; September 1, 1895, appointed Chief of the Time-table and Excursion Department, District Superintendent's Office, Euston ; July 1, 1913, went to the Office of the Superintendent of the Line to take charge of a new department formed to deal with military subjects. Mr. Bradbury was one of the first railway representatives to be admitted "Members of the Order of the British Empire," which honour was awarded him on January 1, 1917, in connection with the preparation and carrying out of the original mobilisation. In addition to his publicity duties he continues in charge of the department for dealing with special military subjects.

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MR. J. ROSTERN, chief goods manager, presided at the recently held 50th annual meeting of the members of the Great Central Railway and Joint Lines Friendly Society. About 130 elected representatives attended the gathering which took place at the Victoria Hall, Sheffield. The statement of accounts showed the reserve funds are now £66,376, an increase of £5,241 over 1920. During the year 43 new members were admitted, 117 members died, and 44 withdrew, leaving the membership 7,107. There are 243 non-resident members and 456 pensioners. Five hundred and thirty-eight widows remain insured for funeral allowances. The value per member has increased from £8 9*s*. 2*d*. to £9 6*s*. 9*d*. In the accident and pension fund the reserve funds show an increase of £4,504 13*s*. 3*d*., and now stand at £102,604 14*s*. 1*d*. The value per member has increased during the year from £13 17*s*. 8*d*. to £14 14*s*. 11*d*. There are now 6,958 members, as against 7,064 in the previous year. The number of pensioners has increased from 630 to 683. In December last Mr. G. F. Stott, secretary of the Friendly Society for the past seventeen years, retired from the service. Mr. Stott has been connected with the society for 46 years.

* * *

AT the April meeting of the Railway Club, Mr. T. M. Lewis read a paper on "The South Eastern and Chatham Railway —Some Suggested Improvements in Cross Country Train Services." The author gave a careful analysis of branch line services and showed how it might be possible to reduce the time now occupied at many junction stations. By kind permission of the London and South Western Railway authorities, the first visit of the season was paid to Feltham marshalling yard on April 22. The party was personally conducted by Mr. F. Bushrod, Assistant Superintendent of the Line, and Mr. Greenfield, Yardmaster, both of whom did everything possible to make the visit an instructive one. Those present were greatly impressed with the simplicity of the arrangements for working the yard. Interest centred round the "Up Hump" signal box, the operation of points and signals, etc., being by means of push buttons mounted on a large diagram which shows the lay-out of the yard.

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"A SPLENDID programme rendered in a style which should satisfy the most severe musical critic," is the opinion expressed by the RAILWAY MAGAZINE representative who attended the Great Eastern Railway Musical Society's concert at Queen's Hall, London, W., on Saturday evening, April 30. Lord Ailwyn was in the chair and Colonel William Johnson Galloway conducted. The male voice choir consists of 200 picked voices, including sections from Cambridge, Ipswich and Norwich, while the full orchestra numbers 100. Both choirs and orchestra are exclusively employees of the company. Among those present, in addition to directors, were most of the chief and district officers of the company, including Sir H. W. Thornton, K.B.E., General Manager. Other railways were in evidence by the presence of many leading officers, not alone from lines with head-

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OFFICERS OF THE CAMBRIAN RAILWAYS COMPANY, 25 MARCH, 1922.

Left to Right.—Seated :—W. Finchett (Goods Manager), R. Williamson (Accountant), G. C. McDonald (Engineer & Locomotive Superintendent), S. Williamson (Secretary & General Manager), W. K. Minshall (Solicitor), T. S. Goldsworthy (Storekeeper), H. Warwick (Superintendent of the Line). Standing :—E. Colclough (Works Manager), J. Williamson (Assistant Engineer), S. G. Vowles (Assistant Secretary), J. Burgess and T. C. Sellars (Assistants to the General Manager).

quarters in London, for the North Eastern and North British Railways were represented. The carrying out of a concert of the magnitude and character of the function under notice involves a great deal of preparatory work, and in this connection special acknowledgment may be made of the Committee of the Great Eastern Railway Musical Society, of which Mr. S. A. Parnwell, Assistant General Manager, is Chairman, and of the Divisional Committees at Cambridge, Ipswich and Norwich, while the immediate responsibilities fell upon Mr. A. W. Headley, Honorary Orchestral and General Secretary. The cover of the programme was the work of Mr. Alfred George May, a clerk in the Chief Civil Engineer's Department at Stratford.

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FOR those who desire inexpensive holidays in Belgium the Great Eastern Railway is making excellent arrangements dating from June 1, when the fine steamers specially equipped for night travel will be operating between Harwich and Zeebrugge, by what is known as the "Daylight Saving Route." The boat from Harwich will take passengers arriving by the train leaving London (Liverpool Street station) at 8.40 p.m. every weekday. There will be a return boat from Zeebrugge daily, except Mondays. The Harwich route to the Continent is well served by restaurant and Pullman car expresses between London and Harwich; restaurant car expresses between Liverpool, Manchester, Sheffield and Harwich; through carriages between Birmingham, Rugby, Peterborough and Harwich, and also by direct services between the Northern and Midland counties of England and the well-known Essex port in question. The Great Eastern Railway has obtained concessions for passengers desiring to spend the week-end in Belgium whereby passports are not necessary in the case of a British subject or a Belgian or French citizen who is resident in the United Kingdom.

* * *

A USEFUL annual is that published by the Great Northern Railway in the form of a Holiday Resorts Guide with a list of hotels, boarding houses and apartments. The 1922 edition is being distributed free of charge, at any G.N.R. office or from the superintendent of the line, King's Cross Station, N. 1. RAILWAY MAGAZINE readers will find this publication extremely handy.

* * *

MESSRS. BASSETT-LOWKE, Limited, Northampton, up-to-date as usual, are making a ½-in. scale model of Mr. Gresley's new Pacific type locomotive, No. 1470, "Great Northern" and expect to have it on view at their London branch, 112, High Holborn, W.C. 1 early in June. The same locomotive forms the subject of the frontispiece to

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this issue of the RAILWAY MAGAZINE and also of an illustrated article by Mr. Chas S. Lake, the well-known author of "The World's Locomotives," and "The Locomotive Simply Explained."

* * *

IT is announced by the Canadian Pacific Railway's Tourist Department that Mr. A. Bryan Williams, who has hunted from one end of British Columbia to the other and who was head of the Provincial Game Department for many years, is now acting as guide and outfitter for hunting and fishing parties. He is prepared to personally conduct sportsmen into the celebrated Cassiar district where mountain sheep, mountain goat, moose, caribou and both grizzly and black bear are reported to be as plentiful as ever they were. Versed as he is from wide experience on all the fine points of big game hunting, Mr. Williams has been very successful in getting his parties not only numerous trophies but some exceptionally find heads. Under ordinary circumstances there should be no difficulty in securing the limit of game which the law allows—the time required to do so being from five to six weeks in the mountains. Itinerary for trip is: leave Vancouver about August 12th by Canadian Pacific steamer to Skagway; thence over the White Pass and Yukon route to Atlin, at which point horses, &c., would be secured for continuance of trip to the hunting grounds. Parties who might be interested in making a hunting excursion into the Cassiar district this autumn under Mr. Williams' auspices should communicate with him at an early date as horses, helpers and steamer accommodation has to be arranged for well in advance. Mr. Williams will quote terms on application. His address is 1170 Georgia Street West, Vancouver, B.C.

* * *

THE London Underground is experimenting with a new mechanical device which will save the travelling public time and trouble at the less busy traffic points. At Aldwych station, which is a quiet traffic centre, a novel electrically-operated machine has been installed inside the lift, enabling the lift man to issue tickets and at the same time to control the working of his lift. The booking of tickets and the admission to the lift being thus concentrated at one time and point and accomplished practically at one movement, there will be a considerable saving of delay and trouble to the passenger. Another notable feature of this new arrangement is the telephone fitted to the machine which enables the operator to communicate with any of the 2,000 telephone extensions of the Underground system in the event of a lift failure occurring at any point in the lift shaft. The whole apparatus, consisting of automaticket machine, lift control and telephone, only takes up the space occupied by two passengers.

* * *

OUR Crewe correspondent writes:—Further 4-6-0 passenger engines ("Prince of Wales" class) have been delivered by Wm Beardmore & Co., Limited, as follows:—. Nos. 557, 17, 549, 558, 198, 354, 778, 1099, 1179, 1316, 1339, 1349, 197 and 433. The first twelve bear Dalmuir works Nos. 236, 238, 239, 243 and 246–253, in the order given. A new series of 0-8-0 superheater goods engines ("G2" class) is now in hand at Crewe. Of these, the first bears the No. 134, while two others will be Nos. 2050 and 2171. The following four-cylinder compound passenger engines have been converted to two-cylinder simple, "Renown" class:—No. 1907, *Black Watch*, No. 1926, *La France*, No. 1941, *Alfred the Great*, No. 1958, *Royal Oak*, and No. 1980 *Neptune*. Latest "Precursor" class locomotives to be superheated and assimilated to the "George the Fifth" class are: No. 282, *Alaric*, No. 2051, *Delamere* and No. 2584, *Velocipede*. Other conversions are: Nos. 815, 1044, 1055, 1230, 1300 and 1896, 0-8-0 "B" class; Nos. 1369 and 2573, 2-8-0, "F" class, and No. 347, 2-8-0, "E" class all of which have been simplified and superheated as 0-8-0, "G1" class. Two further engines of the "Prince of Wales" class have been named, viz., No. 1325, *Disraeli* and No. 940 *Richard Cobden*. The special DX goods engines Nos. 3121, 3437 and 3562 have been broken up.

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MR. C. KLAPPER, of 4, Wellington Road, London, E.3, a convinced advocate of the Kearney high-speed railway system, asks us to mention that a Rapid Transit Society has been formed by a number of Kearney enthusiasts. In connection therewith arrangements have been made for demonstrations on Saturdays at 3 p.m. at the Kearney High-Speed Railway Company's premises. Mr. Klapper will be pleased to supply further particulars.

* * *

MR. E. W. DAY, of Bootle, mentions that a number of former Lancashire and Yorkshire goods, tender and tank engines, are now running in a new livery—a glossy black picked out with thin red lines and minus the words "Lancashire and Yorkshire" or the usual coat of arms. He describes the new colour scheme as "simple yet effective."

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